DEPARTMENT OF DEFENSE APPROPRIATIONS FOR 1952

THURSDAY, JULY 19, 1951

UNITED STATES SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, D. C.

The subcommittee met at 2:15 p. m., pursuant to recess, in room 224, Senate Office Building, Hon. Joseph C. O'Mahoney (chairman of the subcommittee) presiding.

Present: Senators O'Mahoney and Saltonstall.

DEPARTMENT OF THE NAVY

OFFICE OF NAVAL RESEARCH

STATEMENTS OF REAR ADM. CALVIN M. BOLSTER, USN, CHIEF OF NAVAL RESEARCH; MR. WILLIAM W. EDWARDS, FISCAL DIRECTOR, OFFICE OF NAVAL RESEARCH; REAR ADM. MAURICE E. CURTS, USN, ASSISTANT CHIEF OF NAVAL OPERATIONS (READINESS); REAR ADM. EDWARD W. CLEXTON, USN, ASSISTANT COMPTROLLER, DIRECTOR OF BUDGET AND REPORTS; DR. EMANUEL R. PIORE, DEPUTY CHIEF AND CHIEF SCIENTIST, OFFICE OF NAVAL RESEARCH; AND CAPT. FREDERICK R. FURTH, USN, DIRECTOR, NAVAL RESEARCH LABORATORY

GENERAL STATEMENT

Senator O'MAHONEY. We will come to order, gentlemen.

Admiral Bolster, we will be glad to have your statement put in the record now, sir.

Admiral BOLSTER. Mr. Chairman, and members of the committee, although I was attached to the Office of Naval Research in its initial stages as Deputy Chief, this is the first time I have had the pleasure of appearing before you as Chief of Naval Research to present the programs, achievements, and plans of this office.

In general, the major efforts of the Office of Naval Research can be divided into three areas: The conduct of all patent activities of the Navy; the development, installation, and maintenance of special training equipment; and the basic- and applied-research programs.

The primary objective of the patent program is to save money for the Navy and consequently the general public. This is accomplished first by assisting naval and civilian personnel to obtain patents on new developments and inventions arising from their work. Such patents give the Government in general and the Navy in particular the use of

new developments or inventions without the payment of a royalty or license fee.

A second method used is the investigation of all claims against the Navy for the unlicensed use of patented inventions, the disallowance of such claims by means of court action if the claim is invalid, and the negotiation of a settlement if the claim is found to be meritorious.

Additional savings are realized through the investigation of royalty payments on procurement. Where such payments are found to be excessive or unreasonable, refunds are obtained and future payments reduced.

The patent program has in the past and will continue in the future to pay for itself many times over, both in actual measurable dollar savings and to an even greater extent in those savings in dollars that cannot be accurately estimated.

The objective of the program of this office in the field of special training equipment is substantially to increase the speed, quality, safety, and scope of the training equipment and techniques of the Navy. This objective is reached partly through the introduction of the human factor into the design and development of such equipment, but primarily through the simulation of actual operations, emergency, and combat conditions.

Through human engineering, both training and operational, equipment is kept within the physical and mental capabilities of the human operators. By means of highly accurate simulation, men can receive training in combat and emergency situations in complete safety that otherwise would be completely impracticable.

Also, valuable training can be given through the use of simulation equipment in such large-scale operations as fleet maneuvers and recognition and identification of enemy submarines and aircraft at a small fraction of the cost of actually conducting such operations. The need for training greater numbers of personnel in the use of increasingly complex weapons and equipment in less time establishes this program as an integral and essential part of the Navy's defense effort.

PATENT PROGRAM

Senator O'MAHONEY. May I interrupt at that point?

Admiral BOLSTER. Yes, sir.

Senator O'MAHONEY. To go back to the patent program, and the objective of assisting naval and civilian personnel to obtain patents on their own inventions and new developments, what incentive is provided to naval personnel to do this?

Admiral BOLSTER. Actually, Mr. Chairman, at the present time there is not too much incentive. This is one of the things we hope can be corrected.

There is no way other than the normal patriotism of the individual at the present time. I believe that in prior years, the inventor did have the ability to have commercial rights for an invention, which would be of interest to other than military uses.

But I believe that the current Executive order requires the patent to be completely handed over to the Government.

This is one of the things we think should be improved.

Senator O'MAHONEY. Some of the other departments, notably the Department of the Interior, do have a specific plan for providing

incentives by way of awards and so forth. I think it might be well for you to look into that.

Admiral BOLSTER. Yes, sir. We are aware of its need.

Senator O'MAHONEY. It may be that you ought to have some legislation.

Admiral BOLSTER. That is right. We hope that legislation could be enacted.

Senator O'MAHONEY. That is beyond the jurisdiction of this particular inquiry.

Admiral BOLSTER. Yes.

SUGGESTION PROGRAM

Admiral CLEXTON Mr. Chairman, we do have a beneficial suggestion program, wherein administrative changes are suggested which do save some money. We have the same program in the field of industrial work.

Senator O'MAHONEY. Do you have an award for that sort of thing?

Admiral CLEXTON. Yes, sir.

Each year awards are made, that is, cash payments are made, to those who have the best suggestions. It is an extensive program, but it does not cover the patent feature which is being discussed here.

Senator O'MAHONEY. How many patents would you say are obtained during a given period by the Government as a result of the initiative of naval personnel?

Admiral BOLSTER. I imagine, from all of our field activities, the actual applications would be on the order of several hundred a year to be reviewed.

Actually there are nowhere near that many that actually succeed.

BACKLOG

I know that we have been very far behind in the ability to process these patents and there is, I think, a backlog of something like two thousand applications that have not been actually processed.

Senator O'MAHONEY. It would seem to me that a research department ought to be equipped to process such applications.

Admiral BOLSTER. We hope to be. One of the objectives of this budget is to give us the people to do that.

Senator O'MAHONEY. The reason is that they may really turn out some good devices, although I assume that naval personnel are no different from others who write to Senators and Members of Congress occasionally with great ideas which they say have been rejected by people who ought to know better.

Admiral BOLSTER. One of the things we are doing is to put patent people in the field establishments.

For instance, we will put them in a place like the naval ordnance test station at Inyokern or the naval electronics laboratory in San Diego, where people are generating this equipment. We are putting patent people there right on the spot because we find if we don't have them there it is just too much trouble for the inventor to worry about putting it down in writing and putting all the things down that have to be done to make a formal application.

In this way we feel we are actually helping the program.

SIMULATION EQUIPMENT

Senator O'MAHONEY. I am not altogether clear that I get the full implication of the statement in the first paragraph on page b about the training which the Navy gives through simulation equipment, even in large scale operations, such as fleet maneuvers.

What sort of simulated equipment do you have?

Admiral BOLSTER. We have equipment, for instance, called a maneuvering tactics trainer, in which a group of individuals, who might be officers who are going to command various segments of the fleet, sit down and can work out actual operational problems. The problems are simulated by the movements of the ships on a model scale.

You can actually simulate the complete maneuver.

We have another one, an amphibious trainer, which we made for the amphibious training command, in which the various segments of the amphibious landing operations can be simulated.

The people under instructions sit up and watch the instructor go through the maneuver. They can make mistakes or they can do it right, and it can be explained in that way.

Senator O'MAHONEY. How was this simulated equipment developed?

Admiral BOLSTER. This simulation equipment was actually started early in the war, in the aviation field.

I think probably one of the better known examples of a synthetic trainer is the old Link trainer, with which you are probably familiar. That was in the Bureau of Aeronautics.

Admiral DeFlores was the keyman in this whole thing. He started this program in about 1942 after a trip to England where the idea seems to have originated.

He very vigorously pursued it all throughout the war, and by the time the war was over we had a tremendous amount of all kinds of operational flight trainers and other types of training equipment.

This present program is a continuation of the wartime program.

Senator O'MAHONEY. Does the Navy high command agree that this is an efficient, worth-while program?

Admiral BOLSTER. Yes, sir.

Admiral CURTS. One of the prime users is the officer in charge of readiness and training. As that officer in CNO, I am a prime user of these devices and methods. I can say very easily that they save us millions and millions of dollars a year in actual operating of ships.

We still have to do the other, but we can cut down tremendously.

Senator O'MAHONEY. Admiral, can you tell us how much is in this budget for this particular activity?

Admiral BOLSTER. For the development of the training devices, $8 million. Our development program is broken down into the various things we are responsible for, and for the actual direct development of training equipment it is $8 million.

Admiral CURTS. That is in your budget.

Admiral BOLSTER. Yes.

Admiral CURTS. I might say, Mr. Chairman, that procurement of a great many of these training devices will be found in some of the other bureau budgets, particularly in the Bureau of Ships. This, in the ONR budget, is for the development of the first models, the research work to go into getting the first prototype models.

Admiral BOLSTER. We develop the first guinea-pig model to see how you can do it, and then in the case of flight trainers, for instance, the Bureau of Aeronautics pays for the quantity procurement of those.

Senator O'MAHONEY. Of course, we do a lot of aeronautical experimentation through that National Committee.

Admiral BOLSTER. The National Advisory Committee on Aeronautics.

Mr. Chairman, the National Advisory Committee is charged with the responsibility primarily for the research in aerodynamics and hydrodynamics. They do not get into the training requirements at all.

This does not mean that we do not benefit from their research, but the actual development of simulation equipment and training techniques is the responsibility of the services.

Senator O'MAHONEY. Is that really research?

Admiral BOLSTER. Yes, sir; I think it is very much research. The The prototype equipment is research. We do not pay out of our funds for the quantity procurement.

RESEARCH PROGRAM

Senator O'MAHONEY. Will you resume your statement, Admiral?

Admiral BOLSTER. The research program of the Office of Naval Research is carried on both by contract with universities, commercial laboratories, and nonprofit research institutions and in naval and other governmental laboratories.

This program has two principal objectives: (*a*) To increase the general fund of scientific knowledge for the purpose of aiding in the solution of long-range technical and scientific problems of the Navy; and (*b*) to provide specific scientific knowledge and technical know-how to solve immediate naval problems.

During the years leading up to the present emergency, the Navy has been investing in both fundamental and applied research with complete faith in the returns to be received by both the Navy and the Nation from such investment. Such returns have been received to a far greater extent than hoped for by the most optimistic personnel concerned with the establishment of this Office.

The more indirect results of this program include a significant increase in the fund of new scientific knowledge as indicated by reports published in scientific and technical publications and the thousands of scientific reports flowing back to this office.

The number of postgraduate students remaining in university laboratories while obtaining their doctors' degrees has significantly increased.

Of great importance is the high degree of interest in naval scientific and technical problems shown by the Nation's scientific fraternity. This was eloquently illustrated during the last 12 months when the Nation's leading scientists were both willing and able to undertake applied classified research projects of immediate urgency to the Navy.

The most important direct results of this Office's research and development program deal with the solutions of urgent naval problems. These can be discussed off the record, if desired.

If possible, I would like to hold those until we are finished with this statement.

Senator O'MAHONEY. Very well, sir.

Admiral BOLSTER. The funds appropriated during 1951 and requested for 1952 for applied-research projects represent a definite change in emphasis of the ONR programs.

Prior to the first few months of the fiscal year 1951, the emphasis was on fundamental research with a small, but important, amount of applied research on a peacetime time schedule. Peacetime levels of operation also included the development of training equipment, and the processing of patent documents resulting from peacetime levels of industrial development, and research operations.

With the declaration of a state of emergency, a high degree of military preparedness had to be reached in the shortest possible time. One of the key parts of the required degree of readiness was the improvement of weapons, equipment, and operating techniques; the development of training devices for new operational weapons and equipment; and, most important of all, the solution of major scientific, technical, and operational problems facing the Navy and the other armed forces.

It is in this area that the Office of Naval Research is attempting to make its most significant contribution to the war readiness of the Navy.

The material bureaus of the Navy and the Chief of Naval Operations have many difficult problems. The Office of Naval Research is exploiting the potentialities of the Nation's scientific fraternity to the fullest extent possible within its means to study such problems by identifying their individual parts and by having each part subjected to intensive research by the most expert scientists in the field concerned.

Projects of this type are frequently supported jointly by Office of Naval Research and the bureaus of the Navy, and, in some cases, by the three Armed Forces together.

Under the direction of Office of Naval Research, research laboratories throughout the Nation are attempting to apply the latest scientific knowledge and principles to the development of specific military weapons and equipment. Teams of the Nation's leading scientists are attacking service-wide military problems such as air defense and antisubmarine warfare.

Training equipment is being developed concurrently with operational equipment so that training of military personnel may proceed efficiently and effectively. Patent protection for the Navy is being provided to insure the lowest possible cost to the Navy for the use of new discoveries generated under the expanded and accelerated industrial and research activity of the Navy.

APPROPRIATION REQUEST

The 1952 estimate for the appropriation, "Research, Navy," is $69,698,000. This is a net reduction of $10,697,000 from the total amount appropriated in 1951.

However, excluding the $20 million appropriated in the 1951 second supplemental for the extension of certain long-range research projects, it represents an increase of $9,303,000 over the 1951 level.

Of the $69,698,000 requested for the fiscal year 1952, $50,918,000 is required for the direct costs of research and development for both

the contract research program and the programs of the field laboratories; $12,750,000 for the indirect costs of research and development programs including maintenance and operation costs, $2,540,000 for the costs of departmental administration; $2,750,000 for the installation and maintenance of training devices, and $740,000 for the patents program.

RESULTS OF RESEARCH AND DEVELOPMENT PROGRAM

Senator O'MAHONEY. If you will return now to the third page of your statement, we will discuss the results of the research and development program, which is, I think, your real justification. What has been accomplished by the use of this money?

Admiral BOLSTER. I brought a few typical examples, Mr. Chairman.

We feel that a typical example of our basic research program has been the development of a completely new method of producing titanium, which is one of the really important metals today.

As you may know, it is a material having the physical properties of stainless steel, but weighing about half as much as steel.

Senator O'MAHONEY. There is a mountain about 50 miles from Cheyenne, which we call Iron Mountain, which contains deposits of uncertain size of titaniferous ore, and if your research activities resulted in the development of Iron Mountain, I know that the Navy would increase its popularity in Wyoming without any trouble at all.

Admiral BOLSTER. This is what we have done through a small research project: We have now in the laboratory stage a method of producing titanium, of which this is a sample that I have here in my hand.

This is the largest-sized piece we have made up to now. The important thing about it is that it appears now that the cost of producing this will be under a dollar a pound.

Senator O'MAHONEY. This sample you have here was made from what?

Admiral BOLSTER. From the titanium powder. That is the end product of our new process. The process is an electrolytic process.

Senator O'MAHONEY. Does this differ from the process of the Bureau of Mines?

Admiral BOLSTER. Yes, sir. It is a completely new process. The current methods that are known run on the order of five to six dollars a pound.

Senator O'MAHONEY. And did you say this is a dollar a pound?

Admiral BOLSTER. Yes, sir.

I want to repeat that this has only been done on this scale. We have now a pilot plant being developed which will produce this in 50-pound lots, which will be operated about the 1st of September.

Senator O'MAHONEY. Where are you doing this?

Admiral BOLSTER. This started at Princeton, but the pilot plant is being erected at Cleveland.

Senator O'MAHONEY. Is it a naval plant?

Admiral BOLSTER. No, sir. It is being done through a contractor. The contractor who developed this is carrying it further into the pilot plant stage. We gave him a small $25,000 project originally to explore the feasibility of this process.

Senator O'MAHONEY. Do I understand that this contractor is doing it as a private-enterprise project, with naval aid?

Admiral BOLSTER. Actually, the exploration of the pilot-plant process is being paid for by the Navy, to see if this really works. If the thing works, the advantage to the Navy is that we get all of this titanium license-free, that is, royalty-free.

Senator O'MAHONEY. Do I understand that you gave them what amounts to a $25,000 subsidy?

Admiral BOLSTER. Yes, sir; for research in trying to develop this new process. It is an experimental organization, just like any other laboratory.

Senator O'MAHONEY. What does the Navy receive in return for that $25,000?

Admiral BOLSTER. The Navy receives the ability to have this titanium made at $1 a pound rather than $6.

Senator O'MAHONEY. Do you have any exclusive right?

Admiral BOLSTER. Yes, sir. We have the complete license rights on this process. The Navy automatically gets those for having given him that support.

Senator O'MAHONEY. Does the Navy get the patent?

Admiral BOLSTER. I am not sure of that, Mr. Chairman. I don't think that in any of our research projects the patent itself comes to the Navy, but I believe that all of the rights of the patent come to the Navy, to the Government, license-free.

This is not peculiar to this project. This is typical of many development projects that are under way throughout the Armed Forces.

RESEARCH CONTRACT

Senator O'MAHONEY. Suppose you provide for the record a sample of the research contract which is made with private contractors, so that we may see definitely how it works and what the Government receives.

Admiral BOLSTER. Yes, sir.

(The material requested is as follows:)

DEPARTMENT OF THE NAVY

OFFICE OF NAVAL RESEARCH

Contract Number: Nonr–000(01)

RESEARCH AND DEVELOPMENT TASK ORDER

Contractor—XYZ Corporation
Authority—NR 000–000/3–12–51 (---------- Branch)
Appropriation—17X1317.10 Research Navy (Expenditure Account 46110) (Object Classification 079) Program Number ----------
Estimated cost—$100,000.00

This Task Order is established under, and constitutes a part of, Contract Nonr–000(00), which sets forth the basic contract provisions applicable hereto. In case of any conflict between the provisions of said Contract Nonr–000(00), and the provisions hereof, the latter shall control.

SECTION A. The Contractor shall furnish the necessary personnel and facilities for and, in accordance with any instructions issued by the Scientific Officer or his authorized representative, shall (here describe research).

SECTION B. The Scientific Officer under this Task Order is the Head, ---------- Branch, ---------- Division, Office of Naval Research.

SECTION C.—The estimated cost of the performance of this Task Order is one hundred thousand dollars ($100,000.00).

SECTION D. In accordance with the provisions of Section 4 of the contract entitled "Compensation," the Government shall pay to the Contractor as full compensation for the performance of this Task Order the Allowable Costs of the performance of this Task Order, which are hereby defined to include all necessary and reasonable costs of the nature described in subsections (a) through (k) below, incurred by the Contractor directly in the performance of this Task Order in conformity with the Section of the contract entitled "Subcontracts and Purchase Orders" and accepted as such costs by the Bureau of Supplies and Accounts, and an amount for overhead, indirect charges and other elements of cost determined in accordance with subsection (l), below as follows:

(*a*) The cost of materials including (i) the net cost, after deducting all discounts of purchased materials and parts; (ii) the cost of materials and parts withdrawn from the Contractor's store or stock rooms; and (iii) the cost of materials and parts fabricated or partially fabricated by the Contractor and charged in accordance with a sound accounting method consistently followed by the Contractor. Due credit shall be given for any surplus or scrap at current prices whether or not the surplus or scrap is sold.

(*b*) The salaries and wages of the following personnel directly employed in the performance of this Task Order, excluding therefrom old-age benefit, social security, and unemployment compensation taxes pertaining to such employment, payments made for workmen's compensation insurance, overtime premiums, shift premiums, bonuses, pension contributions, and holiday, vacation and sick leave allowances pertaining thereto:

(i) Personnel employed in direct productive labor, generally referred to as "shop labor" or "factory labor";

(ii) Personnel employed in direct engineering labor, including professional engineers, scientists, draftsmen, technicians, and other salaried employees.

(*c*) Premiums paid for overtime hours worked by the personnel specified in subsection (*b*) above, to the extent overtime is authorized in writing by the Contracting Officer, and shift premium paid to such personnel.

(*d*) Purchase, fabrication, or installation cost of special tools, dies, jigs, and other equipment necessary for the performance of this Task Order, as well as the cost of necessary plant rearrangement for the installation of such special tools, dies, jigs, test equipment, etc., and the cost of removal thereof.

(*e*) The costs which the Government is obligated to assume under the Sections of the contract entitled "Property Loss or Damage" and "Insurance—Liability to Third Persons," exclusive of the cost of any insurance allocable to this Task Order, or any insurance which the Government may require or approve under the Section of the contract entitled "Insurance—Liability to Third Persons," it being understood that the cost of all such insurance has been taken into account in computing the amount allowed for overhead in subsection (l), below.

(*f*) Payments of taxes to the extent provided in the Section of the contract entitled "Federal, State, and Local Taxes" and subject to the conditions provided in such Section; and payments of royalties to the extent provided in the Section of the contract entitled "Payment of Royalties."

(*g*) The cost of services directly subcontracted hereunder and not covered by subsection (*d*), above.

(*h*) Transportation expenses (excluding local transportation expense) actually incurred by employees of the Contractor in performance of the work under this Task Order. Transportation by automobile for required travel of employees under this Task Order shall be reimbursed at the rate of five cents (5¢) per mile in lieu of the actual costs of such transportation. The Contractor shall also be allowed the reasonable subsistence expenses of employees while in a travel status.

(*i*) The cost of communication toll charges.

(*j*) The cost of packing, crating, and shipping materials, supplies, and equipment delivered to the Government.

(*k*) Such other items, not expressly excluded by other provisions of the contract or of this Task Order as should, in the opinion of the Contracting Officer, be included in the cost of the work called for in this Task Order. Any such item shall be specifically certified by the Contracting Officer as being allowed under this subsection.

(*l*) An amount for overhead, indirect charges and other elements of cost excluded from or not covered by subsections (*a*) through (*k*), above, equal to one hundred ten percent (110%) of the salaries and wages specified in subsection (*b*), above. This rate shall be a provisional rate which shall be subject to review by the Cost Inspection Service, Bureau of Supplies and Accounts. On the basis of such review, a new overhead rate shall be agreed upon by the Contractor and the

Contracting Officer. The new overhead rate so agreed upon shall be a fixed overhead rate and shall apply retroactively as if agreed upon and incorporated in this Task Order as of the date hereof. Any failure of the Contractor and the Contracting Officer to agree upon a fixed overhead rate hereunder shall be deemed to be a dispute concerning a question of fact to be decided in accordance with the Section of the contract entitled "Disputes."

SECTION E. The Contractor shall submit final reports upon completion of work hereunder, making full disclosure of all research conducted, and shall submit such other reports as are required by the Scientific Officer.

SECTION F. The performance of work under this Task Order shall commence on 15 March 1951, and shall be completed on 14 August 1951.

SECTION G. Unless otherwise provided herein, the Government shall not be under any duty or obligation to restore or rehabilitate, or to pay the costs of the restoration of rehabilitation of the Contractor's plant or any portion thereof which is affected by the removal of any Government Property.

This negotiated contract is entered into pursuant to the provisions of the Armed Services Procurement Act of 1947 (Public Law 413, 80th Congress).

IN WITNESS WHEREOF the parties hereto have executed this contract as of the day and year first above written.

UNITED STATES OF AMERICA
By_____
(Contracting Officer,
Office of Naval Research,
Department of the Navy)

_____
(Contractor)
By_____
Title_____

_____
(Business Address of Contractor)

WITNESSES:
(1)_____
(2)_____

NOTE:—In the case of a corporation witnesses are not required but certificate below must be completed.

CERTIFICATE

I,_____, certify that I am the_____ Secretary of the corporation named as Contractor in the foregoing contract; that_____, who signed said contract on behalf of the Contractor was then_____of said corporation; that said contract was duly signed for and in behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

_____
(Signature of person certifying)

[CORPORATE SEAL]

NAVY DEPARTMENT

OFFICE OF NAVAL RESEARCH

Contract Number X *N* onr *000*(00)

RESEARCH AND DEVELOPMENT TASK ORDER CONTRACT

Contractor.—XYZ Corporation.

Appropriation.—The appropriation or fund, and appropriate expenditure account number, chargeable for work performed under this contract, will be specified in each Task Order for the work under that Task Order.

THIS NEGOTIATED CONTRACT, entered into as of the 15th day of March 1951, between the UNITED STATES OF AMERICA, hereinafter called the "Government," represented by the Contracting Officer executing this contract, and XYZ Corporation, hereinafter called the "Contractor," whose address is (insert address).

WITNESSETH:

WHEREAS, the Contractor has the necessary personnel and facilities for conducting Naval Research and development work; and

WHEREAS, the Government desires the Contractor to conduct such research and development work;

NOW, THEREFORE, in consideration of the mutual covenants hereinafter set forth, the parties hereto do mutually agree as follows:

SECTION 1. SCOPE OF CONTRACT

The Contractor shall supply all necessary personnel, facilities, and materials, and shall use its best efforts to conduct the work specified in each of the Task Orders established hereunder.

SECTION 2. ESTIMATED ALLOWABLE COST

(*a*) It is anticipated that the total cost to the Government, exclusive of any fixed fee, for the full performance of the work specified in any Task Order will not exceed the estimated allowable cost set forth in such Task Order, and the Contractor agrees to use its best efforts to complete the work specified in each Task Order within such estimated allowable cost. The Government shall not be obligated to reimburse the Contractor for, and the Contractor shall not be obligated to incur, expenditures in the performance of work to be performed under any Task Order in excess of the estimated allowable cost specified therein unless and until the Contracting Officer shall notify the Contractor in writing that such estimated allowable cost has been increased, and specify in such notice a revised estimated allowable cost which shall thereupon constitute the estimated allowable cost of the performance of such Task Order.

(*b*) When changes are made, in accordance with the Section of this contract entitled "Changes," in the work specified for performance in any Task Order, and any such change will cause a material increase or decrease in the amount or character of the work to be performed thereunder, or in the time prescribed for the performance thereof, the Contractor and the Contracting Officer, at the request of either party, will enter into negotiations to determine whether equitably there should be any resulting increase or decrease in the related estimated allowable cost and fixed fee, if any, and this contract shall be amended accordingly as may be appropriate.

(*c*) Whenever the then estimated cost of performing a Task Order does not reasonably approximate the estimated allowable cost stated therein, the Contractor shall furnish the Contracting Officer with a revised estimate of the cost of such performance. In the event the revised estimate of such cost is substantially less than the then estimated allowable cost, the Contractor at the request of the Contracting Officer, will enter into negotiations to determine a reduction in the estimated allowable cost and an equitable adjustment in the amount of the fixed fee, if any, and this contract shall be amended accordingly.

(*d*) In the event that the Contracting Officer and the Contractor shall be unable to agree with respect to any determination to be made under subparagraphs (*b*) and (*c*) above, a dispute concerning a question of fact shall be deemed to exist and it shall be treated in the manner provided by the Section of this contract entitled "Disputes."

SECTION 3. SUBCONTRACTS AND PURCHASE ORDERS

(*a*) The Contractor shall give advance notification to the Contracting Officer, or to his authorized representative, before entering into any subcontract or purchase order incident to the performance of this contract which—

(i) is on a cost or cost-plus-fixed-fee basis; or

(ii) is on a fixed-price basis exceeding in dollar amount either $25,000.00 or 5% of the total estimated cost of the Task Order to which it is incident.

(*b*) In addition to giving any advance notification which may be required under subsection (*a*), above, the Contractor shall obtain the written approval of the Contracting Officer, or his authorized representative, to its entering into any subcontract or purchase order incident to the performance of this contract which

(i) involves an expenditure of $2,500.00 or more; or

(ii) involves research or development work; or

(iii) provides for the purchase, rental or other acquisition of real property, the construction or alteration of any building at a cost exceeding $100.00, or the restoration of any altered building; or

(iv) provides for the fabrication, purchase, or installation of any item of scientific or technical equipment at a cost of $500.00 or more, which cost, in accordance with sound accounting principles, would normally be treated as a capital expenditure; or

(v) provides for the fabrication, purchase or installation of any item other than those covered by (iv), above, the cost of which, in accordance with sound accounting principles, would normally be treated as a capital expenditure; or

(vi) provides for the rental of scientific or technical equipment at an annual rental of $500.00 or more, or for the rental of any other capital equipment, including automotive equipment, without regard to amount.

Provided, That the requirements of this subsection (*b*) shall not apply to contracts entered into by the Contractor which provide solely for the personal services of the Contractor's employees.

(*c*) No subcontract or purchase order shall provide for (i) payment on a cost-plus-percentage-of-cost basis or (ii) the payment of a fixed fee in excess of seven per centum (7%) of the estimated cost, exclusive of the fee.

(*d*) The Contractor will give to the Contracting Officer immediate notice of any action or suit filed or any claim made against the Contractor by any subcontractor or vendor relating in any way to this contract and with respect to which the Contractor may be entitled to reimbursement from the Government.

SECTION 4. COMPENSATION

The Government shall pay to the Contractor as full compensation for the performance of this contract the fixed fee, if any, and the Allowable Costs of the performance of this contract, as specfied in each Task Order hereunder.

SECTION 5. PAYMENT

(*a*) Payment of the fixed fee, if any, provided for in each Task Order, shall be made to the Contractor upon its submission of an invoice or invoices to an authorized representative of the Bureau of Supplies and Accounts, each such invoice to be in such amount and submitted at such time as may be provided in the applicable Task Order.

(*b*) Once each month (or at more frequent intervals as may be approved by the Bureau of Supplies and Accounts) the Contractor shall submit to an authorized representative of the Bureau of Supplies and Accounts an invoice supported by a statement of cost incurred by the Contractor in the performance of this contract, and claimed to be includible in Allowable Costs. Such invoices and statements of cost shall be in such form and reasonable detail as the Bureau of Supplies and Accounts shall require. The statements of cost shall be certified by two officers or other responsible officials of the Contractor, one of whom shall be a person supervising accounting with respect to the contract.

(*c*) If requested by the Contractor at the time of submission of any interim invoice and statement of cost, the Government will make provisional payment, except as provided below, of the amount claimed by the Contractor. At any time or times prior to final payment on account of Allowable Costs, the Bureau of Supplies and Accounts shall make such audit of the invoices and statements of costs as it shall deem proper.

(*d*) After payment of eighty percent (80%) of the total estimated cost of any Task Order hereunder, further payments under such Task Order shall be withheld until a reserve of one-half of one percentum of the estimated cost of such Task Order shall have been set aside, such reserve to be paid to the Contractor at the time of final payment under such Task Order. The Contractor and the assignee or assignees, if any, shall execute and deliver at the time of and as a condition precedent to final payment under any Task Order hereunder, a release in form and substance satisfactory to and containing such exceptions as may be found appropriate by the Contracting Officer, discharging the Government, its officers, agents, and employees of and from all claims arising under such Task Order.

(*e*) Any and all partial or advance payments made under this contract shall be secured, when made, by a lien in favor of the Government upon the articles and things contracted for and on all material and other property acquired for or allocated to the performance of this contract, except to the extent that the Government, by virtue of any other provision of this contract, or otherwise, shall have valid title to such articles, things, materials, or other property as against other creditors of the Contractor. If such property is not identified by marking or segregation, the Government shall be deemed to have a lien upon a proportionate part of any mass property with which such property is commingled. Such lien shall be paramount to all other liens under the provisions of an Act approved August 22, 1911 (Pub. No. 41, 62nd Cong.; 37 Stat. 32; U. S. C., Sec. 582).

SECTION 6. CHANGES

The Contracting Officer may at any time, by written order (hereinafter called a "Change Order") addressed to the Contractor, make changes in the specifications of any Task Order established hereunder. Upon receipt of a Change Order, the Contractor shall comply therewith, and shall advise the Contracting Officer of any resulting increase or decrease in the estimated allowable cost of the Task Order affected, and in the time required for completing such Task Order.

SECTION 7. GUARANTEES

The Contractor guarantees that the work hereunder will conform to the requirements of this contract and to the highest professional standards in the field.

SECTION 8. TITLE AND IDENTIFICATION

(*a*) The title to all materials, parts, assemblies, subassemblies, supplies, equipment and other property for the cost of which the Contractor is entitled to be reimbursed hereunder, except property to which the Government already shall have title, automatically shall pass to and vest in the Government (1) in the case of such property which is purchased by the Contractor for the performance of this contract, upon delivery to the Contractor at the Contractor's establishment or at the plant of the supplier on f. o. b. purchases if the Naval Inspector at the Contractor's establishment shall have given his approval, or (2) in the case of property not so purchased, upon the allocation thereof to the contract by the commencement by the Contractor of processing or use thereof or otherwise. Such passage and vesting of title shall not impair any right which the Government might otherwise have under this contract, including but not limited to the right to reject any supplies hereunder, and shall not relieve the Contractor of any of its obligations under this contract.

(*b*) The Contractor agrees that it will, to the extent determined necessary and practical by the Contracting Officer or his authorized representative, identify such property by marking or segregation in such a way as to indicate its ownership by the Government and its allocation to this contract. In any event the Contractor shall maintain adequate accounting control over such property on its books and records.

(*c*) Subject to the provisions of the Section hereof entitled "Property Loss or Damage," following the completion of the contract all such property to which the Government shall have taken title hereunder (including tools, dies, jigs, fixtures, patterns, etc.) and which has not been consumed in the performance of the contract, disposed of in accordance with paragraph (d) hereof or delivered to the Government, shall be retained by the Contractor for use under other contracts with the Government or delivered to the Government f. o. b., the Contractor's establishment as the Contracting Officer or his authorized representative may approve or specify.

(*d*) It is contemplated that all such property will be used by the Contractor only for the performance of this contract or of other cost or cost-plus-fixed-fee contracts with the Navy Department. However, as to any such property not immediately essential to the performance of this contract, including salvage, or scrap material, the Contractor with the written consent of the Contracting Officer may, and at the Contracting Officer's written direction shall, sell, lend or transfer or otherwise dispose of such property to such persons, and upon such terms or conditions, as the Contracting Officer may approve, ratify or direct. The proceeds, if any, of such transfers and dispositions shall, as directed by the Bureau of Supplies and Accounts, be either retained by the Contractor and applied in reduction of payments otherwise due to the Contractor under this contract or under other contracts with the Government, or paid to the Government.

SECTION 9. GOVERNMENT FURNISHED MATERIAL

(*a*) The Government shall furnish the material and equipment listed as Government Furnished Material in each Task Order hereunder, and will furnish such additional material and equipment as it may consider desirable for the Contractor's performance of the contract. All such material and equipment is hereafter called "Government Furnished Material." Title to Government Furnished Material shall be and remain in the Government, and such Government Furnished Material shall be used by the Contractor only for the performances of this contract or other cost or cost-plus-a-fixed-fee contracts with the Navy Department.

(*b*) It is understood that delivery or performance schedules for Task Orders hereunder will be based upon the expectation that such Government Furnished Material will be delivered to the Contractor in sufficient time to enable it to meet said delivery schedules. In the event that any of the Government Furnished Material is not delivered to the Contractor in sufficient time to enable it to meet such delivery or performance schedules, the Contracting Officer upon written request of the Contractor, shall make a determination of the delay occasioned the Contractor thereby and shall grant to the Contractor a corresponding extension of time for the completion of performance. The Government shall not be liable to the Contractor for damages or loss of profit by reason of any delay in delivery of or failure to deliver any or all of the Government Furnished Material.

(*c*) Upon the completion or termination of this contract, the Contractor shall deliver to the Government at such place as shall be specified by the Contracting Officer or his authorized representative, any of the Government Furnished Material not consumed in the projects covered by the terms of this contract or not incorporated in any articles delivered hereunder or not already paid for by the Contractor, subject, however, to the provisions of the Section hereof entitled "Property Loss or Damage."

SECTION 10. PROPERTY LOSS OR DAMAGE

(*a*) The Government has requested that the Contractor not carry, nor incur the expense of, any insurance against any form of loss of or damage to equipment or materials furnished by the Government or any property to which the Government has taken and continues to hold title hereunder, and no reimbursement will be allowed for such insurance premium expenses.

(*b*) In view of the foregoing, the Government assumes the risk of loss or damage to such property, including expenses incidental to such loss or damage. If the Government determines that the repair or replacement of any such property is necessary or advisable for the efficient performance of this contract, the Contractor shall make such repair or replacement and shall be reimbursed by the Government for the cost of so doing; provided, however, that in the case of Government Furnished Material the Government shall make such repair or replacement unless the Contractor undertakes such repair with the approval of the Naval Inspector. Notwithstanding the foregoing assumption of risk, the Contractor shall be responsible for any loss or damage to Government-owned property which results from the Contractor's use of such property for purposes other than the performance of this contract, and for any other loss or damage thereto for which it is expressly made responsible under any other provision of this contract, or which results from willful misconduct or lack of good faith on the part of any of the Contractor's directors, officers, or any of its representatives having supervision or direction of all or substantially all of the Contractor's business or all or substantially all of any plant used by the Contractor in the performance of this contract.

(*c*) Notwithstanding the foregoing provisions, if any property, title to which shall be in the Government, shall be in the plant of a subcontractor in connection with the work to be done under this contract, the Contractor shall require that the subcontractor shall carry insurances (fire and extended coverage) against the usual risks of loss of such property while in the possession of such subcontractor, payable to the subcontractor, the Contractor and the Government as their interests may appear.

SECTION 11. INSURANCE—LIABILITY TO THIRD PERSONS

(*a*) The Contractor shall procure and thereafter maintain workmen's compensation, employer's liability, and bodily injury liability insurance, with respect to work done under this contract, and such other liability insurance with respect to work done under this contract as the Department may from time to time require or approve. All such insurance shall be in such form, in such amounts, for such periods of time, and with such insurers, as the Department may from time to time require or approve.

(*b*) The Contractor shall be reimbursed (1) for the cost of such insurance of the character described in paragraph (a) of this Section as may be required or approved by the Department, (2) for the portion allocable to this contract of the reasonable cost of insurance covering the Contractor's property or property for which the Contractor is responsible to someone other than the Government and which is used or to be used in the performance of this contract, and (3) for liabilities to third persons for loss of or damage to property, death or bodily injury, not compensated by insurance or otherwise, arising out of and incurred during the perform-

ance of this contract, whether or not caused by the negligence of the Contractor, its agents, servants, or employees, provided such liabilities are represented by final judgments or by settlements approved in writing by the Department, and expenses incidental to such liabilities, except liabilities (i) for which the Contractor is otherwise responsible under the express terms of this contract, or (ii) with respect to which the Contractor has failed to insure as required or approved by the Department, or (iii) which result from willful misconduct or lack of good faith on the part of any of the Contractor's directors, officers or of any of its other representatives having supervision or direction of all or substantially all of the Contractor's business or all or substantially all of any plant used by the Contractor in the performance of this contract.

(c) The Contractor shall give the Department or its representative immediate notice of any suit or action filed, or any claim made, against the Contractor arising out of the performance of this contract, the cost and expense of which is reimbursable to the Contractor under the provisions of this contract, and the risk of which is then uninsured or in which the amount claimed exceeds the amount of insurance coverage. The Contractor shall furnish immediately to the Department copies of all pertinent papers received by the Contractor. If the amount of the liability claimed exceeds the amount of insurance coverage, the Contractor shall authorize representatives of the Government to collaborate with counsel for the insurance carrier, if any, in settling or defending such claim. If the liability is not insured, the Contractor shall, if required by the Department, authorize representatives of the Government to settle or defend any such claim and to represent the Contractor in or take charge of any litigation in connection therewith.

SECTION 12 REPORTS OF WORK AND INSPECTION

The Contractor shall submit to the Scientific Officer progress reports as requested by the Scientific Officer and a final report, such reports to make full disclosure of all work performed and the results of such work, provided that the Contractor shall not be required to submit progress reports more frequently than once each month during the term of the contract. Authorized representatives of the Navy Department shall at all reasonable times have the right to inspect the work being performed under this contract. Final acceptance of the work performed under each Task Order shall be made by the Naval Inspector, or the Scientific Officer if so provided in the Task Order.

SECTION 13. WALSH-HEALEY PUBLIC CONTRACTS ACT

If this contract is for the manufacture or furnishing of materials, supplies, articles, or equipment in an amount which exceeds or may exceed $10,000 and is otherwise subject to the Walsh-Healey Public Contracts Act as amended (41 U. S. Code 35–45), there are hereby incorporated by reference all representations and stipulations required by said Act and regulations issued thereunder by the Secretary of Labor, such representations and stipulations being subject to all applicable rulings and interpretations of the Secretary of Labor which are now or may hereafter be in effect.

SECTION 14. EIGHT-HOUR LAW OF 1912

This contract, to the extent that it is of a character specified in the Eight-Hour Law of 1912 as amended (40 U. S. Code 324–326) and is not covered by the Walsh-Healey Public Contracts Act (41 U. S. Code 35–45), is subject to the following provisions and exceptions of said Eight Hour Law of 1912 as amended, and to all other provisions and exceptions of said Law:

No laborer or mechanic doing any part of the work contemplated by this contract, in the employ of the Contractor or any subcontractor contracting for any part of the said work, shall be required or permitted to work more than eight hours in any one calendar day upon such work, except upon the condition that compensation is paid to such laborer or mechanic in accordance with the provisions of this clause. The wages of every such laborer and mechanic employed by the Contractor or any subcontractor engaged in the performance of this contract shall be computed on a basic day rate of eight hours per day; and work in excess of eight hours per day is permitted only upon the condition that every such laborer and mechanic shall be compensated for all hours worked in excess of eight hours per day at not less than one and one-half times the basic rate of pay. For each violation of the requirements of this clause a penalty of five dollars shall be imposed upon the Contractor for each such laborer or mechanic for every calendar day

in which such employee is required or permitted to labor more than eight hours upon said work without receiving compensation computed in accordance with this clause; and all penalties thus imposed shall be withheld for the use and benefit of the Government.

SECTION 15—ASSIGNMENT OF CLAIMS

(*a*) Pursuant to the provisions of the Assignment of Claims Act of 1940 (Act of 9 October 1940; 31 U. S. Code 203, 41 U. S. Code 15), if this contract provides for payments aggregating $1,000 or more, claims for moneys due or to become due the Contractor from the Government under this contract may be assigned to a bank, trust company, or other financing institution, including any Federal lending agency, and may thereafter be further assigned and reassigned to any such institution. Any such assignment or reassignment shall cover all amounts payable under this contract and not already paid, and shall not be made to more than one party, except that any such assignment or reassignment may be made to one party as agent or trustee for two or more parties participating in such financing. Notwithstanding any provision of this contract, payment to an assignee of any claim under this contract shall not be subject to reduction or set-off for any indebtedness of the Contractor to the Government arising independently of this contract. (The preceding sentence applies only if this contract is with a military department.)

(*b*) In no event shall copies of this contract or of any plans, specifications, or other similar documents relating to work under this contract, if marked "Top Secret," "Secret," "Confidential," or "Restricted," be furnished to any assignee of any claim arising under this contract or to any other person not entitled to receive the same; *Provided*, That a copy of any part or all of this contract so marked may be furnished, or any information contained therein may be disclosed, to such assignee upon the prior written authorization of the Contracting Officer.

SECTION 16. RECORDS

(*a*) The Contractor shall keep books, records, documents and other evidence (herein collectively called "the records") bearing on its costs and expenses under this contract and in respect of any termination of work hereunder. The Contractor's method of accounting shall be subject to the approval of the Navy Department, but no material change need be made therein if it conforms to good accounting practice.

(*b*) The Contractor shall furnish to the Navy Department upon request such of the records as may be required by the General Accounting Office.

(*c*) Except for such of the records furnished by the Contractor to the Navy Department pursuant to paragraph (b) of this Section and retained by the Navy Department or the General Accounting Office, the Contractor shall preserve and make available the records in accordance with the provisions of paragraph (h) of the Section of this contract entitled "Termination by the Government." Photographing or micro-photographing of such records and retention of the photographs or microphotographs thereof in accordance with and to the extent authorized by any regulation or amendment thereof issued by the Director of Contract Settlement pursuant to the Contract Settlement Act of 1944 shall constitute compliance with said paragraph (h).

(*d*) The provisions of this Section shall be applicable to, and included in, each fixed-price-adjusted, cost or cost-plus-fixed-fee subcontract made by the Contractor incident to the performance of this contract.

SECTION 17. FEDERAL, STATE, AND LOCAL TAXES

(*a*) *Definitions.*—As used throughout this clause, the following terms shall have the meanings set forth below:

(i) The term "direct tax" means any tax or duty directly applicable to the completed supplies or services covered by this contract, or any other tax or duty from which the Contractor or this transaction is exempt. It includes any tax or duty directly applicable to the importation, production, processing, manufacture, construction, sale, or use of such supplies or services; it also includes any tax levied on, with respect to, or measured by sales, receipts from sales, or use of the supplies or services covered by this contract. The term does not include transportation taxes, unemployment-compensation taxes, social-security taxes, income taxes, excess-profits taxes, capital-stock

taxes, property taxes, and such other taxes as are not within the definition of the term "direct tax" as set forth above in this paragraph.

(ii) The term "contract date" means the effective date of this contract if it is a negotiated contract, or the date set for the opening of bids if it is a contract entered into as a result of formal advertising.

(b) *Federal taxes.*—Except as may be otherwise provided in this contract, the contract price includes all applicable Federal taxes in effect on the contract date.

(c) *State or local taxes.*—Except as may be otherwise provided in this contract, the contract price does not include any State or local direct tax in effect on the contract date.

(d) *Evidence of exemption.*—The Government agrees, upon request of the Contractor, to furnish a tax exemption certificate or other similar evidence of exemption with respect to any direct tax not included in the contract price pursuant to this clause; and the Contractor agrees, in the event of the refusal of the applicable taxing authority to accept such evidence of exemption, (i) promptly to notify the Contracting Officer of such refusal, (ii) to cause the tax in question to be paid in such manner as to preserve all rights to refund thereof, and (iii) if so directed by the Contracting Officer, to take all necessary action, in cooperation with and for the benefit of the Government, to secure a refund of such tax (in which event the Government agrees to reimburse the Contractor for any and all reasonable expenses incurred at its direction).

(e) *Price adjustment.*—If, after the contract date, the Federal Government or any State or local government either (i) imposes or increases (or removes an exemption with respect to) any direct tax, or any tax directly applicable to the materials or components used in the manufacture or furnishing of the completed supplies or services covered by this contract, or (ii) refuses to accept the evidence of exemption, furnished under paragraph (d) hereof, with respect to any direct tax excluded from the contract price, and if under either (i) or (ii) the Contractor is obliged to and does pay or bear the burden of any such tax (and does not secure a refund thereof), the contract price shall be correspondingly increased. If, after the contract date, the Contractor is relieved in whole or in part from the payment or the burden of any direct tax included in the contract price, or any tax directly applicable to the materials or components used in the manufacture or furnishing of the completed supplies or services covered by this contract, the Contractor agrees promptly to notify the Contracting Officer of such relief, and the contract price shall be correspondingly decreased or the amount of such relief paid over to the Government. Invoices or vouchers covering any increase or decrease in contract price pursuant to the provisions of this paragraph shall state the amount thereof, as a separate added or deducted item, and shall identify the particular tax imposed, increased, eliminated, or deceased.

(f) *Refund or draw-back.*—If any tax or duty has been included in the contract price or the price as adjusted under paragraph (e) of this clause, and if the Contractor is entitled to a refund or draw-back by reason of the export or reexport of supplies covered by this contract, or of materials or components used in the manufacture or furnishing of the completed supplies or services covered by this contract, the Contractor agrees that he will promptly notify the Contracting Officer thereof and that the amount of any such refund or draw-back obtained will be paid over to the Government or credited against amounts due from the Government under this contract; *provided*, however, that the Contractor shall not be required to apply for such refund or draw-back unless so requested by the Contracting Officer.

SECTION 18. COVENANT AGAINST CONTINGENT FEES

The Contractor warrants that no person or selling agency has been employed or retained to solicit or secure this contract upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Contractor for the purpose of securing business. For breach or violation of this warranty the Government shall have the right to annul this contract without liability or in its discretion to deduct from the contract price or consideration the full amount of such commission, percentage, brokerage, or contingent fee.

SECTION 19. EXCUSABLE DELAYS

The Contractor shall not be charged with any liability for failure or delay in performance when such failure or delay (herein called an Excusable Delay) is due

to causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to (1) acts of God or of the public enemy, (2) acts of the Government of the United States or any state or political subdivision thereof, (3) fire, floods, explosions, earthquakes or other catastrophes, (4) epidemics, (5) quarantine restrictions, (6) strikes, (7) freight embargoes, (8) unusually severe weather, (9) inability of the Contractor to obtain equipment or material when the Contracting Officer determines that such inability is due to the operation of governmental priorities, preferences, or allocations of equipment or material, or (10) delays of a subcontractor or supplier in furnishing material owing to one or more of the foregoing causes, unless the Contracting Officer shall determine that the materials or supplies to be furnished under the subcontract are procurable from other sources, and shall have ordered the Contractor to procure such materials or supplies from other sources. If the Contractor shall fail to notify the Contracting Officer in writing of the cause of any such failure or delay within twenty (20) days (or such longer period as the Contracting Officer may approve) from the date it appears that such cause will delay deliveries under this contract, the Contractor shall lose all right to the extension of time for delivery by reason of such cause. Upon request of the Contractor the Contracting Officer shall ascertain the facts and extent of failure or delay, and, if he shall find that the failure or delay was occasioned by any one or more of the said causes, he shall revise the delivery schedule accordingly.

SECTION 20. MILITARY SECURITY REQUIREMENTS

(*a*) The provisions of the following paragraphs of this clause shall apply only if and to the extent that this contract involves access to classified matter, which as used in this clause shall mean information or material classified "Top Secret," "Secret," "Confidential," or "Restricted."

(*b*) The Contractor (i) shall be responsible for safeguarding all classified matter and shall not supply or disclose classified matter to any unauthorized person, (ii) shall not make or permit to be made any reproductions of matter classified "Top Secret" except with the prior written authorization of the Contracting Officer, (iii) shall not make or permit to be made any reproductions of matter classified "Secret," "Confidential," or "Restricted," except as may be essential to performance of this contract, (iv) shall submit to the Contracting Officer, at such times as the Contracting Officer may direct an accounting of all reproductions of matter classified "Top Secret," "Secret," or "Confidential," and (v) shall not incorporate in any other project any special features of design or construction which will disclose classified matter, except with the prior written authorization of the Contracting Officer.

(*c*) Except with the prior written consent of the Secretary or his duly authorized representative, the Contractor (i) shall not permit any alien to have access to classified matter, and (ii) shall not permit any individual to have access to matter classified "Top Secret" or "Secret."

(*d*) The Contractor agrees (i) to submit immediately to the Contracting Officer a complete confidential report of any information which the Contractor may have concerning existing or threatened espionage, sabotage, or subversive activity, (ii) to submit to the Contracting Officer, upon written request, any and all information which the Contractor may have concerning any of its employees engaged in any work at any plant, factory, or site at which work under this contract is being performed, and (iii) to exclude from its plant, factory, site, or part thereof, at which work under this contract is being performed, any person or persons whom the Secretary or his duly authorized representative, in the interest of security, may designate in writing.

(*e*) The Contractor is authorized to rely on any letter or other written instrument signed by the Contracting Officer, changing or entirely removing the classification of this contract or of any classified matter.

(*f*) The obligations of the Contractor under this clause shall be in addition to any obligations of the Contractor to comply with all the terms and provisions of any applicable security or secrecy agreement heretofore or hereafter entered into between the Contractor and the Government.

(*g*) The Contractor agrees to insert, in all subcontracts hereunder which involve access to classified matter, provisions which shall conform substantially to the language of this clause, including this paragraph (g): *Provided*, that such provisions need not be included in any subcontract as to which the Contracting Officer shall consent to the omission of such provisions.

SECTION 21. TERMINATION BY THE GOVERNMENT

(*a*) *Notice of termination of Contractor's right to proceed.*—The performance of work under this contract may be terminated by the Government in whole, or from time to time in part, (1) subject to the provisions of the Section hereof entitled "Excusable Delays," whenever the Contractor shall default in performance, or shall so fail to make progress in the prosecution of the work hereunder as to endanger performance (which shall be considered as a default for purposes of this contract) of this contract in accordance with its terms, and shall fail to cure such fault or failure within a period of ten days (or such longer period as the Contracting Officer may allow) after receipt from the Contracting Officer of a notice specifying the fault or failure, or (2) whenever for any reason the Contracting Officer shall determine any such termination is for the best interest of the Government. If termination of work under this contract is simultaneous with, a part of, or in connection with, a general termination (1) of all or substantially all of a group or class of contracts made by the Navy Department for the same product or for closely related products, or (2) of war contracts at, about the time of, or following, the cessation of the present hostilities, or any major part thereof, the termination shall not be for the default of the Contractor, unless the Contracting Officer finds that the Contractor is then in gross or wilful default under this contract. Termination of work hereunder shall be effected by delivery to the Contractor of a Notice of Termination specifying whether termination is for the default of the Contractor or at the option of the Government, the extent to which performance of work under the contract shall be terminated, and the date upon which such termination shall become effective.

(*b*) *Certain obligations of the Contractor.*—After receipt of a Notice of Termination and except as otherwise directed by the Contracting Officer, the Contractor shall (1) terminate work under the contract on the date and to the extent specified in the Notice of Termination; (2) place no further orders or subcontracts for materials, services, or facilities except as may be necessary for completion of such portions of the work under the contract as may not be terminated; (3) terminate all orders and subcontracts to the extent that they relate to the performance of any work terminated by the Notice of Termination; (4) assign to the Government, in the manner and to the extent directed by the Contracting Officer, all of the right, title, and interest of the Contractor under the orders or subcontracts so terminated; (5) settle, with the approval or ratification of the Contracting Officer to the extent that he shall require such approval or ratification (which approval or ratification shall be final for all purposes of this Section), all subcontracts (whether fixed price or cost-plus-a-fixed-fee), obligations, commitments, liabilities, and claims, the cost of which would be reimbursable in accordance with the provisions of this contract in whole, or in part; (6) transfer title (to the extent that title has not already been transferred) and deliver to the Government in the manner, to the extent, and at the times directed by the Contracting Officer (i) the fabricated or unfabricated parts, work in process, completed work, supplies, and other materials produced as a part of or acquired in respect of the performance of, the work terminated in the Notice of Termination, (ii) the plans, drawings, information, and other property which, if the contract had been completed, would be required to be furnished to the Government, and (iii) the jigs, dies, fixtures, and other special tools and tooling acquired or manufactured for the performance of this contract for the cost of which the Contractor has been or will be reimbursed under this contract; (7) use his best efforts to sell in the manner, to the extent, at the time, and at the price or prices directed or authorized by the Contracting Officer, any property (whether or not title thereto has been transferred to the Government for security or otherwise) of the types referred to in subdivision (6) of this paragraph, provided, however, that the Contractor (i) shall not be required to extend credit to any purchaser and (ii) may retain any such property at a price or prices approved by the Contracting Officer, and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Government to the Contractor under this contract or shall otherwise be paid in such manner as the Contracting Officer may direct; (8) complete performance of such part of the work as shall not have been terminated by the Notice of Termination; and (9) take such action as may be necessary or as the Contracting Officer may direct for the protection and preservation of property which is in the possession of the Contractor and in which the Government has or may acquire an interest. The Contractor shall proceed immediately with the prosecution of the work required under this contract notwithstanding any delays in connection with the adjustment of a fixed fee in accordance with this Section.

(*c*) The Contractor and the Contracting Officer may agree upon the whole or any part of the amount or amounts, including an amount with respect to the fixed fee payable under this contract, payable in connection with the Contractor's claim under the contract in the event of the total or partial termination of work pursuant to this Section.

(*d*) In the event of the failure of the Contractor and Contracting Officer to agree as provided in paragraph (*c*) upon the whole amount to be paid to the Contractor in connection with the termination of work pursuant to this Section, the Government, but without duplication of any amounts agreed upon in accordance with paragraph (*c*), shall pay to the Contractor the following amounts:

(1) All costs and expenses reimbursable in accordance with this contract not previously paid to the Contractor for the performance of this contract prior to the effective date of the Notice of Termination and such of these costs as may continue for a reasonable time thereafter with the approval of or as directed by the Contracting Officer (which approval shall not be unreasonably withheld), provided, however, that the Contractor shall proceed as rapidly as practicable to discontinue such costs.

(2) The cost (so far as not included in payment under subparagraph (1), above) of settling and paying claims either arising out of the termination of work under subcontracts or orders or with respect to any other obligations, commitments, and liabilities the cost of which would be reimbursable in accordance with the provisions of this contract or arising in connection with the termination of this contract in whole or in part and properly chargeable to this contract, provided:

(A) Any such claim has been settled by negotiation or otherwise and (1) the Contracting Officer has approved or authorized such settlement in writing or (2) such settlement of a fixed-price subcontract or order calls for payment of an amount not in excess of the amount which would be payable under paragraph (b) of the Approved Termination Provisions for Use in Fixed Price Orders or Subcontracts for the Manufacture of Supplies under Government War Contracts, as amended by General Regulation No. 6 of the Director of Contract Settlement; or

(B) A final judgment has been rendered against the Contractor by a court of competent jurisdiction determining the liability of the Contractor with respect to any such claim, and the Contractor has (1) given the Contracting Officer prompt notice of the initiation of the proceedings in which judgment was rendered and offered in writing to give the Government complete control of the defense of the proceedings, and (2) diligently defended the suit or, in the event that the Government has assumed control of the defense of the proceedings, rendered such reasonable assistance as has been requested by the Government; and provided further that with respect to a judgment determining the liability of the Contractor under any subcontract or order one of the following conditions is satisfied:

(i) the Contracting Officer has approved in writing such subcontract or order or the provisions of such subcontract or order dealing with the rights of the parties thereto upon its termination in whole or in part;

(ii) such subcontract or order (if fixed price) provides in the event of termination thereof in whole or in part for payments to the subcontractor or supplier of an amount not in excess of the amount which would be payable under paragraph (b) of the Approved Termination Provision referred to in paragraph (d) (2) (A), above;

(iii) such subcontract or order (if cost-plus-a-fixed-fee) provides in the event of termination thereof in whole or in part for payment to the subcontractor or supplier of an amount not in excess of cost (together with incidental termination expenses) plus a portion of the fee determined on any reasonable and appropriate basis.

(3) Any other reasonable cost, approved or ratified by the Contracting Officer (which approval or ratification shall not be unreasonably withheld), incidental to the termination of work under this contract, including legal, accounting, clerical and other costs and expenses (taking into account a reasonable allocation of executive, administrative, and office expenses of the Contractor properly allocable to the termination of such work) incidental to:

(i) termination of subcontract or orders hereunder;

(ii) cessation of work in accordance with the Notice of Termination and the determination of the amounts due to subcontractors and other third parties;

(iii) obtaining payment from the Government, but only to the extent reasonably necessary for the preparation and presentation of settlement pro-

posals and cost evidence in connection therewith, provided that termination is not due to default of the Contractor; and

(iv) protection, disposition, removal, storage, and transportation (including delivery costs into any out of storage resulting from directions of the the Contracting Officer), pursuant to paragraphs (b) (7) and (b) (9), hereof, of property in which the Government has or may acquire an interest under this contract (including any Government Furnished Material or Equipment).

(4) A portion of the fixed fee payable under the contract, determined as follows:

(i) In the event of the termination of this contract at the option of the Government and not for the default of the Contractor, there shall be paid a percentage of the total fixed fee equivalent to the percentage of the completion of the work contemplated by the contract, less fixed fee payments previously made, and subject to any adjustments in fixed fee made in accordance with the provisions of this contract;

(ii) In the event of the termination of this contract due to the fault of the Contractor, the total fixed fee payable to the Contractor under this contract shall be such proportionate part of the fee (or, if this contract calls for articles of different types, such part of the fee which is reasonably allocable to the type of article under consideration) as the total number of articles, delivered to and accepted by the Government, bears to the number of articles of a like kind called for by this contract.

If the amount so determined is less than the total payment of fixed fee theretofore made to the Contractor the Contractor shall repay to the Government the excess amount thereof.

(*e*) *Amendment of contract to adjust fixed fee in event of partial termination.*—In case only a part of this contract is terminated the Fixed Fee payable with respect to the work to be performed shall be equitably adjusted and such adjustment shall be reduced to writing as an amendment to this contract prior to final settlement hereunder.

(*f*) *Partial payments.*—The Government shall make advance and partial payments and payments on account, from time to time, of the amounts to which the Contractor shall be entitled under this Section, whether determined by agreement or otherwise, whenever in the opinion of the Contracting Officer, the aggregate of such payments shall be within the amount to which the Contractor will be entitled hereunder. Any such partial payment or payments in the discretion of the Contracting Officer, may be made to the Contractor or directly to, or in escrow for, any subcontractor or third party.

(*g*) *Limitations on the liability of the Government.*—The obligation of the Government to make any payments under this Section (1) shall be subject to deductions in respect of (i) all unliquidated partial or progress payments, payments on account theretofore made to the Contractor and unliquidated advance payments, (ii) any claim which the Government may have against the Contractor in connection with this contract, and (iii) the price agreed upon on the proceeds of sale of any materials, supplies or other things retained by the Contractor or sold, and not otherwise recovered by or credited to the Government, and (2) in the discretion of the Contracting Office, shall be subject to deductions in respect of any claim of any subcontractor or supplier whose subcontract or order shall have been terminated as provided in paragraph (b) (3) except to the extent that such claim covers (i) property or materials delivered to the Contractor, or (ii) services furnished to the Contractor in connection with the production of completed articles under this contract.

(*h*) *Contractor's records.*—Unless a longer period is otherwise provided for in this contract, or by applicable statute, the Contractor for a period of five years after final settlement under the contract shall make available to the Government at all reasonable times at the office of the Contractor all of its books, records, documents, and other evidence bearing on the costs and expenses of the Contractor under the contract and in respect of the termination of work thereunder.

(*i*) *Compensation upon termination.*—In the event the work under this contract is terminated in whole, or from time to time in part, at the option of the Government, pursuant to the provisions of this Section, the Government shall, notwithstanding the provisions of paragraph (c) of this Section, (i) reimburse the Contractor for the costs and expenses specified in subparagraphs (1), (2), and (3) of paragraph (d) of this Section, and (ii) pay to the Contractor that part of the fixed fee, if any, agreed upon to be due the Contractor or, upon the failure to so agree, such amount as is determined by the Contracting Officer to be fair and reasonable.

(*j*) *Limitation of termination costs relating to subcontracts.*—In the event that the work under this contract is terminated in whole, or from time to time in part,

at the option of the Government pursuant to the provisions of paragraph (a) hereof, the Government shall not be obligated to pay to the Contractor any amount for anticipatory profits resulting from the termination or cancellation of any subcontract or order relating to this contract.

SECTION 22. DISPUTES

Except as otherwise provided in this contract, any dispute concerning a question of fact arising under this contract which is not disposed of by agreement shall be decided by the Contracting Officer, who shall reduce his decision to writing and mail or otherwise furnish a copy thereof to the Contractor. Within 30 days from the date of receipt of such copy, the Contractor may appeal by mailing or otherwise furnishing to the Contracting Officer a written appeal addressed to the Secretary, and the decision of the Secretary or his duly authorized representative for the hearing of such appeals shall be final and conclusive; *provided*, that, if no such appeal is taken, the decision of the Contracting Officer shall be final and conclusive. In connection with any appeal proceeding under this clause, the Contractor shall be afforded an opportunity to be heard and to offer evidence in support of its appeal. Pending final decision of a dispute hereunder, the Contractor shall proceed diligently with the performance of the contract and in accordance with the Contracting Officer's decision.

SECTION 23. OFFICIALS NOT TO BENEFIT

No member of or delegate to Congress or resident commissioner, shall be admitted to any share or part of this contract, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.

SECTION 24. NONDISCRIMINATION IN EMPLOYMENT

In connection with the performance of work under this contract, the Contractor agrees not to discriminate against any employee or applicant for employment because of race, creed, color, or national origin; and further agrees to insert the foregoing provision in all subcontracts hereunder except subcontracts for standard commercial supplies or for raw materials.

SECTION 25. CONVICT LABOR

In connection with the performance of work under this contract, the Contractor agrees not to employ any person undergoing sentence of imprisonment at hard labor.

SECTION 26. NOTICE AND ASSISTANCE REGARDING PATENT INFRINGEMENT

(*a*) The Contractor agrees to report to the Contracting Officer, promptly and in a reasonable written detail, each claim of patent infringement based on the performance of this contract and asserted against it, or against any of its subcontractors if it has notice thereof.

(*b*) In the event of litigation against the Government on account of any claim of infrongement arising out of the performance of this contract or out of the use of any supplies furnished or construction work performed hereunder, the Contractor agrees that it will furnish to the Government, upon request, all evidence and information in its possession pertaining to the defense of such litigation. Such information shall be furnished at the expense of the Government except in those cases in which the Contractor has agreed to indemnify the Government against the claim being asserted.

SECTION 27. FILING OF PATENT APPLICATIONS

(*a*) While and so long as the subject matter of this contract is classified "Secret" or higher, the Contractor agrees that, before filing or causing to be filed a patent application disclosing any of said subject matter, it will refer the proposed application to the Contracting Officer for determination whether, for reasons of national security, such application should be kept secret or the issuance of a patent thereunder otherwise delayed, under pertinent statutes or regulations; and the Contractor agrees to observe any instructions given by the Contracting Officer in this regard, which instructions may include a direction not to file such application so long as

the Contracting Officer considers that such filing would jeopardize national security. If the Contracting Officer directs the Contractor not to file such application, the Contractor may submit to the Contracting Officer a written request, addressed to the Secretary, for reconsideration of such direction, but pending action by the Secretary, the Contractor shall observe such instruction.

(*b*) While and so long as the subject matter of this contract is classified "Confidential" or higher, and if the Contracting Officer determines that there is no other practical means for maintaining the security of said subject matter, the Contractor agrees to assign and convey to the Government upon request the entire right, title, and interest in and to each United States patent application disclosing said subject matter and filed by or on behalf of the Contractor, the title to the assigned patent application to be held in trust by the Government, subject to reversion of the entire right, title, and interest therein to the Contractor (i) upon allowance of the said application and payment of the final fee, or (ii) upon the mailing of notice by the Contracting Officer to the Contractor that disclosure of the subject matter of the application will no longer jeopardize security. Nothing contained in this paragraph shall (A) apply to any patent application assigned to the Government under any other provision of this contract, or (B) enlarge or diminish the rights granted to or reserved by the Government or the Contractor with respect to said application or the invention covered thereby, except to the extent expressly provided in this clause.

(*c*) While and so long as the subject matter of this contract is classified "Confidential," the Contractor agrees to furnish to the Contracting Officer, at the time of or prior to filing or causing to be filed a patent application disclosing any of said subject matter, a copy of such application for determination whether, for reasons of national security, such application should be kept secret or the issuance of a patent thereunder otherwise delayed, under pertinent statutes or regulations; and the Contractor agrees to observe any instructions of the Contracting Officer in this regard.

(*d*) While and so long as the subject matter of this contract is classified "Restricted," the Contractor shall be governed by the provisions of the clause of this contract entitled "Military Security Requirements."

SECTION 28. REPORTING OF ROYALTIES

If this contract is in an amount which exceeds $10,000, the Contractor agrees to report in writing to the Contracting Officer, during the performance of this contract and prior to its completion or final settlement, the amount of any royalties or royalty rates paid or to be paid by it directly to others in connection with the performance of this contract, together with the names and addresses of licensors to whom such payments are made and either the patent numbers involved or such other information as will permit identification of the patents or other basis on which royalties are to be paid. Where the Contractor's compliance with the foregoing reporting requirement if found by the Contracting Officer to be impracticable because of the size of the Contractor's business or because of the nature of its accounting procedures, the Contractor may furnish one or more reports, based on its established accounting periods and covering the entire contract period, of royalties in excess of $1,000 (if computed on an annual basis) paid to or to be paid to each licensor on the Contractor's over-all business, together with such other information as will permit identification of the patents or other basis on which royalties are to be paid, in which event the Contractor shall furnish the Contracting Officer, upon his request and at Government expense, an allocation of such royalty payments to Government business or to the work or supplies covered by this contract; reference to any such periodic royalty reports, previously furnished to any Government agency and covering the period of performance of this contract, shall constitute compliance with the reporting requirement of this clause.

If this contract is in an amount which exceeds $10,000, and no royalties or royalty rates are paid or to be paid directly to others under the circumstances set forth above, the Contractor agrees so to report in writing to the Contracting Officer prior to completion or final settlement of this contract.

SECTION 29. PATENT RIGHTS

(*a*) As used in this clause, the following terms shall have the meanings set forth below:

(i) The term "Subject Invention" means any invention, improvement, or discovery (whether or not patentable) conceived or first actually reduced to

practice either (A) in the performance of the experimental, developmental, or research work called for under this contract, or (B) in the performance of any experimental, developmental, or research work relating to the subject matter of this contract which was done upon the understanding that a contract would be awarded.

(ii) The term "Technical Personnel" means any person employed by or working under contract with the Contractor (other than a subcontractor whose responsibilities with respect to rights accruing to the Government in inventions arising under subcontracts are set forth in paragraphs (f), (g), and (h), this clause), provided that such person, by reason of the nature of his duties in connection with the performance of this contract, would reasonably be expected to make inventions.

(iii) The terms "subcontract" and "subcontractor" means any subcontract or subcontractor of the Contractor, and any lower-tier subcontract or subcontractor under this contract.

(*b*) The Contractor agrees to and does hereby grant to the Government an irrevocable, nonexclusive, nontransferable, and royalty-free license to practice, and cause to be practiced for the Government throughout the world, each Subject Invention in the manufacture, use, and disposition according to law, of any article or material, and in the use of any method: *Provided, however*, That with respect to (i) any Subject Invention made by other than Technical Personnel, (ii) any Subject Invention conceived prior to any performance of this contract as set forth in paragraph (a) above but first actually reduced to practice in the course of any such performance, and (iii) the practice of any Subject Invention in foreign countries, the said license and other rights hereinafter provided shall be to the extent of the Contractor's right to grant the same without incurring any obligation to pay royalties or other compensation to others solely on account of said grant. Nothing contained in this paragraph shall be deemed to grant any license under any invention other than a Subject Invention. Any license granted herein shall not convey any right to the Government to manufacture, have manufactured, or use any Subject Invention for the purpose of providing services or supplies to the general public in competition with the Contractor or the Contractor's commercial licensees in the licensed fields.

(*c*) The Contractor agrees as follows: (i) to make written disclosure promptly to the Contracting Officer of each Subject Invention which reasonably appears to be patentable and to exert all reasonable effort to make such disclosure not later than 6 months after first publication, public use, or sale; (ii) to specify, at the time of such disclosure, whether or not said Subject Invention has been or will be claimed in a United States patent application and unless it thereafter notifies the Government to the contrary not later than 8 months after first publication, public use, or sale, to file or cause to be filed in due form and time a United States patent application covering each Subject Invention so specified, (iii) to the extent of the Contractor's right to do so, to deliver to the Contracting Officer such duly executed instruments (prepared by the Government) of assignment, application papers and rightful oaths as are necessary to vest in the Government the sole and exclusive ownership, and the right to apply for and prosecute patent applications covering, each Subject Invention which the Contractor does not specify as aforesaid (or having so specified, thereafter notifies the Government to the contrary), subject, however, to the reservation of a nonexclusive and royalty-free license thereunder to the Contractor (and to its associated and affiliated companies, if any, within the corporate structure of which the Contractor is a part), which license shall be assignable to the successor of that part of the Contractor's business to which it pertains; (iv) to furnish promptly to the Contracting Officer on request an irrevocable power of attorney to inspect and make copies of each United States patent application as filed by or on behalf of the Contractor covering any Subject Invention; (v) in the event the Contractor elects not to continue prosecution of any such United States patent application filed by the Contractor, so notify the Contracting Officer not less than 60 days before the expiration of the response period, and upon written request, to deliver to the Contracting Officer, to the extent of the Contractor's right to do so, a duly executed assignment to the Government of the entire rights to such patent application and any Subject Invention claimed therein subject to a reservation as specified in (iii) above; and (vi) to deliver to the Contracting Officer duly executed instruments fully confirmatory of any license rights herein agreed to be granted to the Government. If, to the best of the Contractor's knowledge and belief, no inventions have been conceived or first actually reduced to practice under this contract, the Contractor shall so certify to the Contracting Officer.

(*d*) The Contractor agrees to and does hereby grant to the Government, to the full extent of the Contractor's right to do so without payment of compensation to others, the right to reproduce, use and disclose for governmental purposes (including the right to give to foreign governments for their use as the national interest of the United States may demand) all or any part of the reports, drawings, blueprints, data, and technical information specified to be delivered by the Contractor to the Government under this contract: *Provided, however*, That nothing contained in this paragraph shall be deemed, directly or by implication, to grant any license under any patent now or hereafter issued or to grant any right to reproduce anything else called for by this contract.

(*e*) Until the Contractor has delivered to the Government the disclosures required by paragraph (c) (i) of this clause and the information as to any subcontractor required by paragraph (g) of this clause, there shall be withheld from final payment under this contract ten percent (10%) of the contract price, or $5,000, whichever is smaller: *Provided, however*, That the withholding of the aforesaid amount, or subsequent payment thereof to the Contractor, shall not be construed as a waiver of any rights accruing to the Government under this contract: and *Provided further*, That any amount so withheld under this paragraph shall not be in addition to any amounts withheld under other provisions of this contract. This paragraph shall not be construed as requiring the Contractor to withhold any amounts from a subcontractor to enforce compliance with the patent provisions of a subcontract.

(*f*) The Contractor agrees to exert all reasonable effort to negotiate for the inclusion in any subcontract hereunder of $3,000 or more, in which payment is to be made for experimental, developmental or research work, of this patent rights clause or one approved by the Contracting Officer. In the event of refusal by a subcontractor to accept such patent rights clause, the Contractor shall obtain written authorization of the Contracting Officer (which authorization may be granted with respect to a particular subcontract) to proceed with the subcontract, and shall cooperate with the Government in the negotiation with such subcontractor of a mutually acceptable patent rights clause: *Provided, however*, That the Contractor shall in any event require the subcontractor to grant to the Government patent rights under Subject Inventions of no less scope and on no less favorable terms than those which the Contractor has under such subcontracts, except that in no event shall the subcontractor be required to grant to the Government patent rights in excess of those herein agreed to be granted to the Government by the Contractor.

(*g*) The Contractor agrees to notify the Contracting Officer in writing of any subcontract containing a patent rights clause, to furnish to the Contracting Officer a copy of such clause, and promptly to notify the Contracting Officer when such subcontract is completed. It is understood that with respect to such subcontract clause, the Government is a third party beneficiary; and the Contractor hereby assigns to the Government all the rights that the Contractor would have to enforce the obligations of the subcontractor with respect to Subject Inventions. The Contractor shall not be obligated to enforce the agreements of any subcontractor hereunder relating to a patent rights clause in any subcontract.

(*h*) When the Contractor shows that it has been delayed in the performance of this contract by reason of its inability to obtain, under reasonable terms that include a suitable patent rights clause, a qualified subcontractor for any particular part, item or function of this contract for which the Contractor itself does not have available facilities or qualified personnel, the Contractor's delivery dates shall be extended for a period of time equal to the duration of such delay; and, upon request of the Contractor, the Contracting Officer shall determine to what extent, if any, an additional extension of the delivery dates, and an increase in contract price based upon additional costs incurred, are proper under the circumstances; and the contract shall be modified accordingly. If the Contractor, after exerting all reasonable effort, is unable to obtain a qualified subcontractor as set forth above, the Contractor may submit to the Contracting Officer a written request for waiver or modification of the requirement that a suitable patent rights clause be included in the subcontract. Such request shall specifically state that the Contractor has used all reasonable efforts to obtain such qualified subcontractor and shall cite the waiver or termination provisions herein set forth. If, within thirty-five (35) days after the date of receipt of such request for a waiver or modification of said requirement, the Contracting Officer shall fail to grant such request, the requirement shall be deemed to have been waived by the Government. If within such period the Contractor shall receive a written denial of such request by the Contracting Officer, this contract shall thereupon automatically terminate and the

rights and obligations of the parties shall be governed by the provisions of the cause of this contract entitled "Termination for the Convenience of the Government" just as if a notice of termination had been delivered to the Contractor specifying that the contract was terminated for the convenience of the Government.

SECTION 30. FOREIGN PATENT RIGHTS

The Contractor agrees, notwithstanding any other provisions in this contract to the contrary, (i) to grant to the Government, upon request, title to the foreign rights in each Subject Invention (as defined in the clause of this contract entitled "Patent Rights"), (ii) to inform the Contracting Officer, at the time of making the disclosure provided for under the terms of paragraph (c) (i) of the clause of this contract entitled "Patent Rights," whether or not there has been a publication of such invention and if so, the date and identity of such publication and (iii) to deliver to the Contracting Officer such duly executed instruments (prepared by the Government) of assignment, application papers and rightful oaths as are necessary to vest in the Government with respect to each Subject Invention (A) the sole and exclusive ownership in any foreign patent application and any patent that may issue thereon, and (B) the right to apply for and prosecute such foreign patent applications.

SECTION 31. BUY AMERICAN ACT

The Contractor agrees that there will be delivered under this contract only such unmanufactured articles, materials, and supplies (which term "articles, materials, and supplies" is hereinafter referred to in this clause as "supplies") as have been mined or produced in the United States, and only such manufactured supplies as have been manufactured in the United States substantially all from supplies mined, produced, or manufactured, as the case may be, in the United States. Pursuant to the Buy American Act (41 U. S. Code 10 a–c), the foregoing provision shall not apply (i) with respect to supplies excepted by the Secretary from the application of that Act, (ii) with respect to supplies for use outside the United States, (iii) with respect to the supplies to be delivered under this contract which are of a class or kind determined by the Secretary or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, or (iv) with respect to such supplies, from which the supplies to be delivered under this contract are manufactured, as are of a class or kind determined by the Secretary or his duly authorized representative not to be mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, provided that this exception (iv) shall not permit delivery of supplies manufactured outside the United States if such supplies are manufactured in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.

SECTION 32. RENEGOTIATION

(*a*) This contract is subject to the Renegotiation Act of 1951 (P. L. 9, 82nd Congress) and shall be deemed to contain all the provisions required by Section 104 of said Act.

(*b*) The Contractor (which term as used in this clause means the party contracting to furnish the materials or perform the work required by this contract) agrees to insert the provisions of this clause, including this paragraph (b), in all subcontracts as required by Section 104 of the Renegotiation Act of 1951; *provided*, that the Contractor shall not be required to insert the provisions of this clause in any subcontract of a class or type described in Section 106 (a) of the Renegotiation Act of 1951.

SECTION 33. DEFINITIONS

As used in this contract:

(*a*) The term "Secretary of the Navy" includes any person authorized to act for him except that such term as used in Section 22 (Disputes) does not include the Contracting Officer or any representative or subordinate of the Contracting Officer;

(*b*) The term "Contracting Officer" as used herein shall mean the officer signing this contract and all other Contracting Officers of the Office of Naval Research acting within the scope of their authority;

(*c*) The term "authorized representative of the Contracting Officer" shall mean any person authorized to act for the Contracting Officer,

(*d*) The term "Scientific Officer" means the official of the Navy Department designated as such in each Task Order;

(*e*) The term "Bureau of Supplies and Accounts" means said Bureau in the Navy Department; and

(*f*) The term "Task Order" means the written specification of work authorized by the Government and accepted by the Contractor for performance in accordance with the terms in such Task Order and this agreement.

This negotiated contract is entered into pursuant to the provisions of the Armed Services Procurement Act of 1947 (Public Law 413, 80th Congress).

IN WITNESS WHEREOF the parties hereto have executed this contract as of the day and year first above written.

UNITED STATES OF AMERICA

By _____
(Contracting Officer, Office of Naval Research, Department of the Navy)

_____
(Contractor)

By _____

Title _____

_____
(Business Address of Contractor)

WITNESSES:

(1) _____

(2) _____

NOTE.—In the case of a corporation witnesses are not required but certificate below must be completed.

CERTIFICATE

I, _____, certify that I am the _____ Secretary of the corporation named as Contractor in the foregoing contract; that _____, who signed said contract on behalf of the Contractor was then _____ of said corporation; that said contract was duly signed for and in behalf of said corporation by authority of its governing body and is within the scope of its corporate powers.

_____
(Signature of person certifying)

[CORPORATE SEAL]

BILLING INSTRUCTIONS FOR COST-TYPE CONTRACTS

Strict compliance with the Billing Instructions will facilitate early payment of invoices. No payment can be made, however, until the contract is returned, properly executed, to the Office of Naval Research, Navy Department, Washington 25, D. C.

1. General

In case of conflict between the provisions of the Billing Instructions and the express terms of the contract, the express terms of the contract shall control.

2. Preparation of invoices

(a) *Concerning the general form of invoices.*—Invoices are to be prepared by contractors on their regular billing forms. There is required to be stamped, printed or typewritten *upon* the original copy of each invoice the following certificate:

"I certify that the above bill is correct and just; that payment therefor has not been received; that all statutory requirements as to American production and labor standards, and all conditions of purchase applicable to the transactions have been complied with; and that State or local sales taxes are not included in the amounts billed.

"I further certify that the personal services and the supplies, equipment, materials, etc., listed hereon were required by and were used in the performance of the work under the contract referred to on this voucher and that payments have been made of all amounts for which reimbursements are hereby claimed; that the amounts claimed for personal services involving part-time work, determined from a distribution of wages for the period indicated to be directly chargeable to the United States under the provisions of the contract referred to on this voucher, are true and correct and that payments of these amounts have been made to all employees whose wages are included in the distribution, that payrolls, procurement records, invoices and requisitions concerned will be kept for at least four years,

subject to inspection upon request by authorized representatives of the United States Government; that no individual items costing $50 or more have been been included in the subtotals and totals of charges for which no itemizations or evidentiary substantiations are furnished; and that the research provided for in said contract has been conducted in accordance with the terms thereof, during that part of the period specified therein to which the costs stated in this voucher are applicable.

"----------
"Contractor.

"By ----------
"Authorized Representative."

Such certificate must actually appear *on* the original copy of the invoice—an accompanying, annexed or separate certificate will not be acceptable—and must be signed in the name and on behalf of the contractor by an authorized representative.

(b) *Concerning assignments.*—Notwithstanding an assignment of money claims pursuant to authority contained in the contract, the contractor—not the assignee—is required to prepare invoices. Where such an assignment has been made, the original copy of the invoice must refer to the assignment and must show that payment of the invoice is to be made directly to the assignee, as follows:

"Pursuant to the instrument of assignment, dated ----------, make payment of this invoice to (name and address of assignee).

"----------
"Contractor.

"By ----------
Title.

3. Marking of shipping containers

The following information must plainly appear on all shipping boxes or containers:

(1) Name of Contractor
(2) Name and Address of Consignee
(3) Contract Number Preceded by N—onr Symbol
(4) Contents (only if contract is unclassified):
  (a) Item or Items
  (b) Identification or Model Designation of Item or Items
  (c) Quantity of Each Item or Items

4. Submission of invoices and place of payment

Unless specific instructions to the contrary are furnished with a task order, the following instructions shall apply:

Invoices under contract Nonr-394 (00) will be submitted by you to the United States Navy Cost Inspector designated in instructions which will be issued to you by the Supervisory Cost Inspector, United States Navy, Central Area, room 803, Custom House Building, 610 South Canal Street, Chicago 7, Ill., for verification, preparation of public vouchers, and forwarding to the Office of Naval Research Branch Office, America Fore Building, 844 North Rush Street, Chicago, Ill., for certification as to receipt and acceptance and transmittal (except final invoice) to the United States Navy Regional Accounts Office, Ninth Naval District, Building 1B, Naval Training Center, Great Lakes, Ill., where payment will be made.

The final certified invoice will be transmitted by the afore-mentioned Branch Office to the afore-mentioned Regional Accounts Office VIA (1) THE SUPERVISORY COST INSPECTOR, U. S. N., CENTRAL AREA, AND (2) THE CONTRACT ADMINISTRATION BRANCH, OFFICE OF NAVAL RESEARCH, DEPARTMENT OF THE NAVY, WASHINGTON 25, D. C.

Senator O'MAHONEY. Has the Bureau of Mines been consulted about this development at all?

Admiral BOLSTER. Yes, sir.

Actually, we have made it a point to inform the metallurgical advisory committee under the National Research Council. There is a metallurgical advisory committee under the National Research Council, which is now charged with looking into all metallurgical programs. They have been told about this sometime ago.

The Air Force and the Army people responsible for metallurgical titanium work have been made aware of it.

I would like to say that in the field of metallurgy there is a very close association among the people in the business. The word gets around very quickly.

USES FOR TITANIUM

Senator O'MAHONEY. So that those who read the record may understand what we are talking about, please make a brief statement of the naval uses for titanium.

Admiral BOLSTER. The importance of titanium to the Navy would be to replace in large measure the stainless steel now used in aircraft construction in such places as fire walls, bulkheads, sheet-metal skins of supersonic aircraft and missiles; the compressors of gas turbines; piping for salt water systems, and condenser tubes.

The most important use would be in the aircraft industry, where the availability of the material having great corrosion resistance of extremely light weight would be most important.

DEVELOPMENT OF FILTER PAPER

Senator O'MAHONEY. Can you tell us about another item you have developed?

Admiral BOLSTER. This will be off the record.

(Discussion off the record.)

Senator O'MAHONEY. Can you make a brief statement on that now, for the record, Captain Furth?

Captain FURTH. In an effort to provide from local sources an efficient filter paper, the Naval Research Laboratory, in its experimentation, has produced a paper using very fine glass fibers. This paper is 99.997 percent efficient in removing aerosols from smokes. It has been turned over to industry.

Many, many inquiries have been made by various industries on the possible uses of the paper and several paper companies are investigating its production. One company has already gone into this and has improved the tensile strength of our paper. It shows the amount of interest there is in it.

Senator O'MAHONEY. I would assume the glass companies would be interested.

Admiral BOLSTER. Yes.

Captain FURTH. The production of the mica paper, making use of Canadian and domestic scrap mica, provides this country with a source of a dielectric material, where heretofore they were dependent upon the importation of critical materials.

Domestic mica has ordinarily been found in small rather than in large pieces; small flakes.

There is such a large percentage of magnetite in domestic mica that heretofore they have not been able to separate magnetite from the mica, and then when they get the mica it is in small flakes. The new process involves putting the small flakes together and making a continuous sheet.

So, actually, no chemicals of any kind are involved.

Senator O'MAHONEY. Your research laboratory, then, has developed a method by which this small flake domestic mica can be used; is that correct?

Captain FURTH. Exactly, sir.

And this also has stirred a great deal of interest in industry. As a matter of fact, the latest word that I have had is that a number of people have raised the capital and are starting a new industry in the production of this mica paper.

Senator O'MAHONEY. Captain Furth, could you give us any idea as to what the market might be for mica by reason of this development?

Captain FURTH. The electronics industry in one case used a tremendous amount of kraft paper in the production of very, very small capacitors,

This paper will replace the kraft paper and will give to the services and to the commercial home television viewer as well, a more reliable product because it permits the equipment to operate at very much higher temperatures without failure. It is not that we are looking to operate it at higher temperatures, but sometimes that occurs with all the tubes in a piece of equipment.

I have no money value which I can give you of what the kraft paper industry is, but the capacitor industry is a very, very large industry.

RESEARCH AND DEVELOPMENT

Senator O'MAHONEY. Are there any other products that you have developed?

Captain FURTH. There is one other product, right in the same line again.

We also have devised a process now for making use of Canadian asbestos fiber and can clean magnetite out of that fiber and bind that fiber to quite an efficient filter paper.

Senator O'MAHONEY. The estimate for research and development for 1952 was $50,000,000, $50,918,000, as compared with $63,678,000 for 1951.

This reduction is due to what?

Admiral BOSTER. As I explained in the statement, Mr. Chairman, actually this is not a reduction but an increase. In the fiscal year 1951 the Office of Naval Research received a special appropriation of $20 million to extend the life of this research program.

This $20 million was appropriated for a specific purpose and did not in any way increase the level of the operation, but was to extend the life of the projects. This was considered desirable, because it permits our research projects to have a longer life and therefore to be a much more stable program.

But the point is that actually our research and development program for 1952 will require a small increase.

Is that correct?

Mr. EDWARDS. The actual level of program operation has increased. There is a $12 million net decrease in dollars, but the operating level of the research and development program has increased about $7 million.

Senator SALTONSTALL. Your statement would show there was an increase of $9,303,000 over the 1951 level.

Mr. EDWARDS. That is the total of all programs. We are talking about the research and development program only.

Senator SALTONSTALL. Mr. Chairman, may I respectfully ask a question, if you are through?

Senator O'MAHONEY. Go right ahead.

Senator SALTONSTALL. Admiral Bolster, I would like to ask a couple of questions along these lines:

There is a new Director of Defense Research, who has just been appointed, Mr. Whitman.

Admiral BOLSTER. Yes, sir; the new chairman of the Research and Development Board.

Senator SALTONSTALL. And actually your appointment is pending before the armed services, too, at the same time.

Admiral BOLSTER. Yes, sir.

COORDINATION OF RESEARCH PROGRAMS

Senator SALTONSTALL. Could you describe the relationship of your research department in the Navy with the research department in the Department of Defense, how it works together, and how you have meetings and get together with the Army research and the Air research, with the Department of Defense?

How much control does the Department of Defense research chairman or commission have over you, and do you make any contributions from the Navy research to the Department of Defense research?

Admiral BOLSTER. I think the best way to explain that would be to say that each department has its own research and development program, for which funds are appropriated.

Within the Navy, of course, this is divided up among the several bureaus and the Office of Naval Research.

Senator SALTONSTALL. But it is under your head, is it?

Admiral BOLSTER. I am the Chief of Naval Research; yes, sir. And I am responsible for the coordination of the research phases of our program.

Admiral Curts, who is here today, is responsible for the over-all coordination of the total navy research and development program as being chairman of the Research and Development Review Board of the Navy; the philosophy being that the research and development programs of the Navy really exist to develop things based on the operational requirements of the Chief of Naval Operations.

Senator SALTONSTALL. What are the total funds applied to research in the Navy, over and above this $69 million that you show here?

Admiral BOLSTER. I would like to ask Admiral Clexton to answer that.

Admiral CLEXTON. The total funds requested in the 1952 budget for direct research and development are $425 million.

Senator SALTONSTALL. Do you have any idea, Admiral, of approximately what the Army has?

Admiral CURTS. The Army has approximately $365 million, and the Air Force $425 million.

Also, last year for the first time your committees established a revolving fund, if you will, for the Research and Development Board of the Department of Defense, who can allocate funds to the various departments to spend for projects which may come up.

Senator SALTONSTALL. Then quick addition would show it is about $1,200,000,000 involved for the three departments.

Admiral CURTS. That is correct.

Senator SALTONSTALL. Is there any amount directly appropriated to the Department of Defense research?

Admiral CURTS. No, sir; none except to operate the Research and Development Board, which is not an operating research agency. It is only a coordinating board.

EMERGENCY FUND

Admiral CLEXTON. The emergency fund which is to be appropriated in 1952 to the Department of Defense has in its budget estimate $90 million, under the language:

> For transfer by the Secretary of Defense, with the approval of the Bureau of the Budget, to any appropriation for military functions under the Department of Defense available for research and development, to be merged with and to be available for the same purposes and for the same time period as the appropriation to which transferred.

Senator SALTONSTALL. That would mean, then, that you have approximately $1,300,000,000 if you include that $90 million. That would be in round figures.

Admiral CURTS. Yes, sir.

Senator SALTONSTALL. I would be very much interested to know the relationship of the Department of Defense research commission with these various commissions of yours. How much responsibility do they have?

Assume, Admiral Bolster, that you wanted to do something on this mica paper that we were just discussing and the Department of Defense said, "No; the Army is doing that. We want to stop you. The Army will do that one, and you will do the submarine-engine business," what can you say?

Admiral BOLSTER. Mr. Chairman, I might explain how the programs are coordinated.

Each program we submit from the Navy consists of a number of projects. Each project describes in detail what we plan to undertake. Those projects are forwarded as a total research and development program of the Navy to the Research and Development Board. The Research and Development Board, of course, is the main Board, of which Admiral Curts and Mr. Kimball are the two Navy members. There are two members from each of the three departments, an Under Secretary and one military member.

Senator SALTONSTALL. How many from the Department of Defense?

Admiral BOLSTER. One, the Chairman.

Senator SALTONSTALL. Just the Chairman?

Admiral BOLSTER. Yes, sir; that makes a total of seven.

Within the Board, however, the Board consists of a number of committees. These committees are divided up in the various areas in which all the departments carry out research and development work.

You have a committee for ordnance; you have a committee on aeronautics; you have a committee on guided missiles; you have a committee on human resources; and several others.

They actually cover all of the important areas that have to be worked on.

The current arrangement is that within each committee you have a number of panels. For instance, in the Committee on Aeronautics you have a panel on propulsive systems. You have another panel on airframes, and you break it down still farther.

Senator SALTONSTALL. Those panels are made up of whom?

Admiral BOLSTER. Those panels are made up of representatives of the departments and civilians from outside the Defense Establishment.

Senator SALTONSTALL. Are they chosen by the Department?

Admiral BOLSTER. They are chosen actually by the Research and Development Board. I think the Chairman has the ability to appoint memberships to the committees and to the panels, that is the civilian memberships.

Actually, they come from industry; from laboratories; from universities, wherever you can get the best men. They come in and work part time in serving on these panels.

Normally the panels review the projects that are submitted and consequently they are reviewed by all three departments.

The whole idea in the creation of the Research and Development Board was for the very reasons that you pointed out, so that we would know among the services what the others were doing.

Senator SALTONSTALL. I think I know your answer to this question: Is there free give-and-take, or is each service pretty rigid?

Admiral BOLSTER. I don't quite understand your question, sir.

Senator O'MAHONEY. Do you share the results of your research?

Senator SALTONSTALL. And also are you willing to give and take in the other people's ideas?

Admiral BOLSTER. Certainly.

Admiral CURTS. We not only give and take, but we are grasping.

Admiral BOLSTER. We actually make a point of trying to find out what everybody else is doing, and I think Dr. Piore will tell you that the scientist wants to know what everybody else is doing.

DISCUSSION ON COORDINATION OF IDEAS

Senator O'MAHONEY. Senator, you were in the middle of a question when we were called on a futile errand to the floor.

Senator SALTONSTALL. Thank you, Mr. Chairman.

What interests me very much, Admiral, is how flexible, candidly, how flexible, you have your minds set.

I mean, supposing the Navy has one way of doing it, and the Air Force has another way of doing it. Do both members of the Navy come up there with their minds saying, "No, these fellows are wrong," or do they come up with the idea and say they are going to get the best out of them that they can?

Admiral BOLSTER. I think that is a fair question, and I can say that there is a sincere desire on the part of all of us that participate in research and development work to find out the best way to do it.

Senator SALTONSTALL. You have loosened up, then?

Admiral BOLSTER. Yes, sir. I have been concerned largely with the aeronautical field. We make a practice of going to Wright Field and telling them what we are doing, and to try to keep in touch.

Now, actually, this coordination goes on at all levels, and you will find that the best coordination is at the level of the worker himself, down in the branch, that is working on a particular problem, such as fuels, lubricants, materials, or engines.

Those people know the other people in the field, and there is a constant interchange of information.

Senator SALTONSTALL. What we want to get, of course, at the present time, and if we have future troubles, we do not want to get a repetition of what went on in World War II.

Dr. Vannevar Bush told about how they had to use some of their special funds in that Bush committee to experiment on the Duck,

I think it was, and then the Duck was so successful in Africa that then the military forces took it over.

They could never sell the idea of the Duck to any of the military groups, the Army, the Navy, or the Air Force.

We do not want that to happen again, do we?

Dr. PIORE. I think there is one very important element in all of this. All of these sort of differences of opinion occur in the presence of supposedly noninterested civilians who are chosen by the Board down in a panel level.

Now, the Army, Navy, and Air Force can be unreasonable as anything. But before a neutral crowd, you cannot maintain a position for the position's sake alone when arguing on technical matters.

I mean, I am not a legal person, but you always have the impression that legal people maintain positions for legal opinion.

In scientific and technical subjects, this becomes very difficult, especially when you have three supposedly neutral people. They just embarrass the devil out of you.

Then it goes up through a whole procedure which sort of takes care of these.

Senator SALTONSTALL. Then you put confidence in a system which has put civilian members on these panel boards?

Dr. PIORE. Yes, sir.

Senator SALTONSTALL. You put confidence into that as giving flexibility of thought that will come up to the past levels?

Admiral BOLSTER. Objectivity; yes, sir.

Admiral CURTS. Senator Saltonstall, I have had a tremendous amount of experience in coordinating research and development and evaluation of weapons, not only in our service, but between the Army, and later on, the Air Force, when it became a separate Air Force from the Air Corps.

I can definitely assure you that never has there been a higher degree of coordination between the three services in research and development and the grasping of anything good from one service to another in this weapon field or research field than there is right now.

Senator SALTONSTALL. I think that is fine.

POLICY DETERMINATION

Senator O'MAHONEY. If I understood one of your answers to one of the earlier questions of Senator Saltonstall, it was to the effect that the research and development activity receives instructions from higher authority as to objectives for research and development.

You are told what the goal is and you go out and try to obtain it; is that not right?

Admiral BOLSTER. Well, this is correct in connection with weapons or military-equipment development. The Chief of Naval Operations, through his various deputies, his organization, and from the fleet, has generated operational requirements.

These operational requirements are very broad statements as to the need for a functional piece of equipment or a technique to accomplish a specific end. They do not care how you accomplish it. They want a piece of equipment that will do the job required.

The responsibility of the development agencies is to figure out how to provide that equipment in the most efficient possible way.

There are many other contributions that come into that. You have to develop not only equipments, but you have to develop techniques,

and this whole operation stems from the operational requirements of the Navy; the fighting ability of the Navy.

Senator O'MAHONEY. To give an example, during the war it was desired to transfer a large battleship, I think from the Atlantic to the Pacific. The question was whether it could go through the Panama Canal. The task of finding out whether it could go through the Panama Canal was given to the David Taylor model basin.

There the plan was worked out so that that vessel did go through the canal with about an eighth of an inch to spare on each side, or some narrow measurement. That was the story we had at the time.

Is that the way your work develops?

If an operation is to be performed, or a new weapon seems desirable, or a new propulsion device seems highly necessary, you are asked to go and search for it, from the Navy high command?

Admiral BOLSTER. The operational requirements are pretty specific. For instance, in the field of aircraft, they might tell you to develop a helicopter capable of landing and taking off from a merchant ship.

Senator O'MAHONEY. Well, it comes down that way. Does any of it go up from the research and development laboratories and staffs?

Admiral BOLSTER. It flows both ways. The flow is up from the point of view that in research we find out that we are able to do things that the operating people do not know are possible. We inform them of these new possibilities, new operational capabilities. This new information results in operational requirements being generated directing us to pursue that new phenomena or new technique.

There is a two-way flow all the time.

Senator O'MAHONEY. Is there any rivalry that tends to close the door to new ideas?

Admiral BOLSTER. I would say that the rivalry does not close the door. I think that rivalry in research and development should rather be called competition.

Senator O'MAHONEY. There is a rivalry that works for progress?

Admiral BOLSTER. Yes, sir. There is another phase I would like to point out, and this certainly can be on the record.

SPECIAL DEVICES CENTER

At the Special Devices Center, the Army actually is participating in this operation to the extent that we have a colonel and a staff of officers working with our people, developing training equipment with the Army using the same personnel and facilities that have developed equipment for the Navy.

Senator SALTONSTALL. We will swing to a new point of view for just a moment.

Assume, we will say, DuPont or Monsanto, or General Electric, came up with an idea which had nothing to do with the Navy, but they think that it can be taken advantage of by the Navy. They bring that idea into the Navy.

Where does that go?

Admiral BOLSTER. Well, if this were a proposal in research, if they wanted to explore some phenomena in research, it would come to us; it would come to the Office of Naval Research.

If it were in the field of chemistry or physics, or some other field, it would be evaluated together with other proposals that we had received to see if it was really worth while for the Navy to embark on.

HANDLING OF INVENTIONS

Senator SALTONSTALL. Suppose a simple inventor, and every Senator gets some requests, comes forward with an idea that he thinks is excellent. Where does he go?

Admiral BOLSTER. This invention might flow into the services through any of the bureaus, but it would probably end up somewhere in our over-all patent organization.

We have patent people and invention people in the bureaus. If it was an invention on how to land an airplane on a carrier, for instance, it would be evaluated and looked at by the people that are responsible for that type of equipment.

Senator SALTONSTALL. That would not necessarily go through your department?

Admiral BOLSTER. Not necessarily. It would go through the technical division that is best capable of commenting on it.

It might well be that in the last analysis we would have to prepare the reply to this man.

But we would get the technical information for the reply from the people that knew the answer, that were in that business.

Senator SALTONSTALL. Let me ask two more questions.

I asked, during the recess here, and I would now like to get it on the record, a question somewhat as follows:

Assume there is a project that you want to put in an educational institution, like MIT. Does the Navy take that project up to the Department of Defense, to this coordinating board, and then have it come back to the Navy to put into execution, and then it comes out of your money?

Admiral BOLSTER. Yes, sir; that would be exactly the same as any other research and development project.

It would be submitted for review by the appropriate panel of the research and development board, and, if approved, we would then be authorized to engage in this program or this project with the institution.

There is no difference between carrying out a research program with an institution such as MIT, or with an industrial laboratory, as far as the mechanics are concerned.

True, there are at the present time a number of projects being created where the Armed Forces, on a joint basis, are going to the universities and asking them to undertake the solution of major warfare problems.

In those cases, they are coorindated by the three services before they become a final program.

Dr. PIORE. Could I expand on this question?

Major areas are approved by the Research and Development Board. If you follow precisely the procedure indicated, for every proposal that comes in, first going to the Research and Development Board, then coming back to the agency that naturally writes the contract, you are just introducing a lot of complex machinery, and you are also requesting the Research and Development Board to grow and grow and grow.

I mean, simply our contract program quite apart from the Navy's laboratories, involves about 2,000 tasks. Now, just physically processing that number through the RDB, of getting the stamp of approval, you create chaos.

The only thing you can expect RDB to do is to provide you intellectual guidance and permit the operating people to worry about the details, whether it goes to Joe Bloke or some one else or whether he gets $5,000 or $7,500 to do the work.

Senator SALTONSTALL. Assume that the project was going to cost more than the allotment of the funds that the Navy could allot. Would the Research and Development Board of the Department of Defense give you some out of its emergency fund, or could it go to the Army?

Admiral BOLSTER. I would rather have Admiral Curts answer the question.

Admiral CURTS. It could not legally tell the Army, with the strings that you gentlemen put on appropriations, to transfer funds from the Army to the Navy for that particular fund, but it could stop a project within the Navy, or tell you to put this emphasis on that, and allow you discretion as to where you stop it.

They can initiate, stop, accent, or deaccent any project.

But, of course, they cannot transcend the wishes of Congress and the way they write the appropriations act. There is enough money in there so there is not any necessity of that.

NAVY RESEARCH BOARD

Senator SALTONSTALL. I have just one more question, and I thank the chairman for the privilege.

What is the connection of the Navy Research Board, we will say, with the National Aeronautics Commission?

Of course, the National Aeronautics Commission gets a very substantial appropriation. Do I understand correctly that the National Aeronautics Commission is interested more in long-range research, we will say, on new type jet planes and new type helicopters, rather than the immediate adjustments that might be necessary?

What is your relation, and do you contribute any funds to them?

Admiral BOLSTER. I think you are speaking of the National Advisory Committee for Aeronautics which is charged with the responsibility for conducting research for both the military departments and civilian industry—national research in the field of aeronautics.

They also conduct research in the field of aircraft power plants, to a certain extent, in connection with fundamental programs.

They also do some hydrodynamic research. Their appropriations are their own, and are defended by them.

The appropriation for NACA to conduct such research, which is on a very broad scale and, as you know, consists of the operation of laboratories at Langley Field, at Cleveland, and at Moffet Field, in California, is a separate item.

Senator SALTONSTALL. It is a long-range program?

Admiral BOLSTER. It is a long-range research program.

They do participate with us very closely, for instance, in the field of high-speed flight, both the Navy and the Air Force engaging in the construction of high-speed research aircraft.

These aircraft are instrumented and flown by the NACA. The D–558, the Skyrocket, is an example of that.

Senator SALTONSTALL. Take, for example, the trouble over Indiana, the Air Force with the icing of these inlet valves, intakes.

If that happened in the Navy, would that be a Navy job, or would that be turned over?

Admiral BOLSTER. That would be something that would be solved by ourselves, icing up of power plants, and trying to lick cooling problems.

The National Advisory Committee might well be in a position to advise. You might go to them for consulting purposes.

Their desire and their work is to tell engine builders how they can build efficient turbines; how they can make a better compressor so that the engine will be more efficient.

Senator SALTONSTALL. There is no duplication between them?

Admiral BOLSTER. I would say not, sir, at all.

Senator SALTONSTALL. Would you say that you benefit from them?

Admiral BOLSTER. We benefit greatly from NACA.

Senator SALTONSTALL. But they do not benefit from you, except through trial and error?

Admiral BOLSTER. I think they do, in programs of trial airplanes. We provide them with equipment that they could not possibly have.

Senator SALTONSTALL. Thank you, Mr. Chairman.

Senator O'MAHONEY. Turn to page 8, will you, Admiral, of the justification?

The budget request under the research and development program, amounting to $50,918,000, is divided into four sections.

CONTRACT RESEARCH PROGRAM

The first of these, and the largest, by far, is the contract research program, amounting to $33,668,000.

Admiral BOLSTER. Yes, sir.

Senator O'MAHONEY. The Naval Research Laboratory asks for $9 million; for the Special Devices Center, which has already been discussed, you ask $8 million; and for the Underwater Sound Reference Laboratory, you ask $250,000.

That indicates, you see, clearly, that two-thirds of your money is desired for contract work at outside institutions.

Admiral BOLSTER. Yes, sir.

Senator O'MAHONEY. Could not more of it be done in the Naval Research Laboratory?

Admiral BOLSTER. No, sir.

I would like to expand on that a little bit.

This fund, this contract research program, actually consists of three major areas. It consists of the continuing fundamental research work that has been going on through the years at approximately a $15,000,000 level, in which we are engaged in exploring, really finding out the facts of nature; how we can do things better in fields such as electronics, chemistry, physics, materials, and things of that nature.

Senator O'MAHONEY. That is continuous work?

Admiral BOLSTER. Yes, sir; and those are long-range research programs.

Senator O'MAHONEY. Where is it being done?

Admiral BOLSTER. That is being done in universities and other laboratories throughout the country.

It is carried on, as I was saying, in various places, wherever we can get the best work done. The projects, individual projects, are rather modest.

What we do in projects of that type is to find the best possible investigator in the field, and give him the authority to go ahead and try to find out more about it.

Senator O'MAHONEY. But you just said that this is a continuing study.

Admiral BOLSTER. It is. By that I meant that you give a man a contract to do research. It has to be approximately 24 months' life in order for him to really be able to do something about it.

It takes him a while to get his equipment together.

Senator O'MAHONEY. You are speaking in the personal sense as giving it to a man. Is it to an individual or to an institution?

Admiral BOLSTER. It is always to an institution.

But, in general, in basic research, you seek out a principal investigator who you know will be competent and has competent people working for him and the facilities to do the work.

Senator O'MAHONEY. Could you give us a list to which these contracts are given?

Admiral BOLSTER. Yes, sir.

Senator O'MAHONEY. Just file that for the record, please, sir.

(The list referred to is as follows:)

LIST OF UNIVERSITIES, COLLEGES, AND NONPROFIT INSTITUTIONS CONDUCTING RESEARCH AND DEVELOPMENT UNDER CONTRACT WITH THE OFFICE OF NAVAL RESEARCH

Academy of Natural Sciences, Philadelphia, Pa.
Acoustical Society of America, Washington, D. C.
Alabama Polytechnic Institute, Auburn, Ala.
Alabama, University of, University, Ala.
Alfred University, Alfred, N. Y.
American Antarctic Association, Washington, D. C.
American Council on Education, Washington, D. C.
American Geographical Society, New York, N. Y.
American Institute for Research, Pittsburgh, Pa.
American Institute of Biological Sciences, Washington, D. C.
American Institute of Crop Ecology, Washington, D. C.
American Institute of Physics, New York, N. Y.
American Mathematical Society, New York, N. Y.
American Museum of Natural History, New York, N. Y.
American Society for Heating and Ventilating Engineers, Cleveland, Ohio
American Society of Mechanical Engineers, New York, N. Y.
American University, Washington, D. C.
Amherst College, Amherst, Mass.
Arctic Institute of North America, New York, N. Y.
Arizona, University of, Tucson, Ariz.
Arkansas, University of, Fayetteville, Ark.
Armour Research Foundation, Chicago, Ill.
Atlanta University, Atlanta, Ga.
Bartol Research Foundation, Swarthmore, Pa.
Batelle Memorial Institute, Columbus, Ohio
Baylor University, Houston, Tex.
Bethany College, Bethany, W. Va.
Boston University, Boston, Mass.
Brooklyn College, Brooklyn, N. Y.
Brown University, Providence, R. I.
Bryn Mawr Hospital, Bryn Mawr, Pa.
Buffalo, University of, Buffalo, N. Y.
California Academy of Sciences, San Francisco, Calif.
California Institute of Technology, Pasadena, Calif.
California, University of, Berkeley, Calif.
California, University of, at Los Angeles, Los Angeles, Calif.
Carnegie Institute of Technology, Pittsburgh, Pa.
Carnegie Institute of Washington, Washington, D. C.
Case School of Applied Sciences, Cleveland, Ohio
Catholic University, Washington, D. C.

Central Institute of the Deaf, St. Louis, Mo.
Chattanooga, University of, Chattanooga, Tenn.
Chicago, University of, Chicago, Ill.
Children's Hospital, Philadelphia, Pa.
Children's Hospital, Washington, D. C.
Cincinnati, University of, Cincinnati, Ohio
Clark University, Worcester, Mass.
Clemson Agriculture College, Clemson, S. C.
Cleveland Clinic Foundation, Cleveland, Ohio
Colgate University, Hamilton, N. Y.
Colorado A. & M. College, Fort Collins, Colo.
Colorado, University of, Boulder, Colo.
Columbia University, New York, N. Y.
Connecticut, University of, Storrs, Conn.
Cornell University, Ithaca, N. Y.
Creighton School of Medicine, Omaha, Nebr.
Daniel Guggenheim Airship Institute, Akron, Ohio
Dartmouth College, Hanover, N. H.
Delaware, University of, Newark, Del.
Denver, University of, Denver, Colo.
Detroit, University of, Detroit, Mich.
Doctors Hospital, Washington, D. C.
Duke University, Durham, N. C.
Emory University, Emory, Ga.
Fisk University, Nashville, Tenn.
Florida Southern College, Lakeland, Fla.
Florida State University, Tallahassee, Fla.
Fordham University, New York, N. Y.
Franklin Institute, Philadelphia, Pa.
Furman University, Greenville, S. C.
Gannon College, Erie, Pa.
George Washington University, Washington, D. C.
Georgetown University, Washington, D. C.
Georgia School of Technology, Atlanta, Ga.
Georgia, University of, Athens, Ga.
Gonzaga University, Spokane, Wash.
Grinnell College, Grinnell, Iowa
Hahnemann Medical College, Philadelphia, Pa.
Harvard University, Cambridge, Mass.
Hawaii University, Honolulu, T. H.
Howard University, Washington, D. C.
Hunter College, New York, N. Y.
Illinois Institute of Technology, Chicago, Ill.
Illinois, University of, Urbana, Ill.
Indiana, University of, Bloomington, Ind.
Institute for Advanced Study, Princeton, N. J.
Institute for Cancer Research, Philadelphia, Pa.
Institute for Research in Human Relations, Philadelphia, Pa.
Institute of Paper Chemistry, Appleton, Wis.
Institute of Textile Technology, Charlottesville, Va.
Iowa State College, Ames, Iowa
Iowa, State University of, Iowa City, Iowa
Jefferson Medical College, Philadelphia, Pa.
Johns Hopkins University, Baltimore, Md.
Kansas State College, Manhattan, Kans.
Kansas, University of, Lawrence, Kans.
Kirksville College, Kirksville, Mo.
Lehigh University, Bethlehem, Pa.
Lightning and Transient Research Institute, Minneapolis, Minn
Linfield College, McNinnville, Oreg.
Louisville, University of, Louisville, Ky.
Louisiana State University, Baton Rouge, La.
Lowell Observatory, Flagstaff, Ariz.
Loyola University, Chicago, Ill.
Maine, University of, Orone, Maine
Marine Biological Laboratory, Woods Hole, Mass.
Maryland, University of, College Park, Md.

Massachusetts General Hospital, Boston, Mass.
Massachusetts Institute of Technology, Cambridge, Mass.
Massachusetts, University of, Amherst, Mass.
Mayo Clinic and Mayo Foundation, Rochester, Minn.
Medical College of Virginia, Richmond, Va.
Medical Evangelists College, Loma Linda, Calif.
Meharry Medical College, Nashville, Tenn.
Memorial Hospital, New York, N. Y.
Miami, University of, Coral Gables, Fla.
Michigan State College, East Lansing, Mich.
Michigan, University of, Ann Arbor, Mich.
Minnesota, University of, Minneapolis, Minn.
Mississippi State College, State College, Miss.
Missouri, University of, Columbia, Mo.
Montana State College, Bozeman, Mont.
Mount Holyoke College, South Hadley, Mass.
Mount Sinai Hospital, New York, N. Y.
Nantucket Maria Mitchell Association, Nantucket, Mass.
National Academy of Sciences, Washington, D. C.
National Research Council, Washington, D. C.
Nebraska, University of, Lincoln, Nebr.
Nevada, University of, Reno, Nev.
New Hampshire, University of, Durham, N. H.
New Mexico School of Mines, Albuquerque, N. Mex.
New Mexico, University of, Albuquerque, N. Mex.
New York Cancer Institute, New York, N. Y.
New York Medical College, New York, N. Y.
New York State Psychiatric Institute, New York, N. Y.
New York University, New York, N. Y.
North Carolina State College, Raleigh, N. C.
North Carolina, University of, Chapel Hill, N. C.
Northwestern University, Evanston, Ill.
Notre Dame, University of, Notre Dame, Ind.
Oberlin College, Oberlin, Ohio.
Occidental College, Los Angeles, Calif.
Ohio State University, Columbus, Ohio.
Oklahoma A & M College, Stillwater, Okla.
Oklahoma, University of, Norman, Okla.
Oregon State College, Corvallis, Oreg.
Oregon, University of, Eugene, Oreg.
Pennsylvania State College, State College, Pa.
Pennsylvania, University of, Philadelphia, Pa.
Pittsburgh, University of, Pittsburgh, Pa.
Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
Pomona College, Claremont, Calif.
Princeton University, Princeton, N. J.
Psychological Research Center, Los Angeles, Calif.
Puerto Rico, University of, Rio Piedras, P. R.
Purdue University, Lafayette, Ind.
Queens College, Flushing, N. Y.
Randolph Macon College, Lynchburg, Va.
Reed College, Portland, Oreg.
Rensellear Polytechnic Institute, Troy, N. Y.
Rhode Island State College, Kingston, R. I.
Rice Institute, Houston, Tex.
Richmond, University of, Richmond, Va.
Rochester, University of, Rochester, N. Y.
Rockhurst College, Kansas City, Mo.
Rutgers College, New Brunswick, N. J
Santa Clara, University of, Santa Clara, Calif.
Saranac Lake Study and Craft Guild, Saranac Lake, N. Y.
Scripps Institute of Oceanography, La Jolla, Calif.
Scripps Metabolic Clinic, San Diego, Calif.
Smith College, Northampton, Mass.
Smithsonian Institution, Washington, D. C.
Society of Naval Architects, New York, N. Y.
Southern California, University of, Los Angeles, Calif.

South Dakota, University of, Vermillion, S. Dak.
Southern Research Institute, Birmingham, Ala.
Springfield College, Springfield ,Mass.
Stanford Research Institute, Stanford, Calif.
Stanford University, Palo Alta, Calif.
Stefansson, Dr. Vilhjalmar, New York, N. Y.
Stevens Institute of Technology, Hoboken, N. J.
St. Lawrence University, Canton, N. Y.
St. Louis University, St. Louis, Mo.
St. Luke's Hospital, New York, N. Y.
St. Olaf College, Northfield, Minn.
Swarthmore College, Swarthmore, Pa.
Syracuse University, Syracuse, N. Y.
Temple University, Philadelphia, Pa.
Tennessee, University of, Knoxville, Tenn.
Tennessee Agricultural and Industrial State College, Nashville, Tenn
Texas A. & M. Research Foundation, College Station, Tex.
Texas, University of, Austin, Tex.
Textile Foundation, Princeton, N. J.
Toledo, University of, Toledo, Ohio.
Trudeau Foundation, Saranac Lake, N. Y.
Tufts College, Medford, Mass.
Tulane University, New Orleans, La.
Tuskegee Institute, Tuskegee, Ala.
Union College, Schenectady, N. Y.
Utah, University of, Salt Lake City, Utah.
Vanderbilt University, Nashville, Tenn.
Vermont, University of, Burlington, Vt.
Virginia, University of, Charlottesville, Va.
Wake Forest College, Winston-Salem, N. C.
Washington School of Psychiatry, Washington, D. C.
Washington, State College of, Pullman, Wash.
Washington University, St. Louis, Mo
Washington, University of, Seattle, Wash.
Wayne University, Detroit, Mich.
Wesleyan University, Middletown, Conn.
Western Reserve University, Cleveland, Ohio.
Wichita, University of, Wichita, Kans.
Wisconsin, University of, Madison, Wis.
Woods Hole Oceanographic Institute, Woods Hole, Mass.
Worcester Foundation, Shrewsburg, Mass.
Worcester Polytechnic Institute, Worcester, Mass.
Yale University, New Haven, Conn.

LIST OF INDUSTRIAL FIRMS CONDUCTING RESEARCH AND DEVELOPMENT UNDER CONTRACT WITH THE OFFICE OF NAVAL RESEARCH

Aerojet Engineering Corp., Pasadena, Calif.
Aircraft Armaments, Inc., Baltimore, Md.
American Electro Metal Corp., Yonkers, N. Y.
American Instrument Co., Silver Spring, Md.
Askania Regulator Co., Chicago, Ill.
Astorphysical Research Inc., New York, N. Y.
Atlantic Research Corp., Washington, D. C.
Austin Co., New York, N. Y.
Baird Associates Inc., Boston, Mass.
Baker Manufacturing Co., Evansville, Wis.
Bath Iron Works Corp., Bath, Maine.
Bausch & Lomb Optical Co., Rochester, N. Y.
Carl, J. H. & Sons, New York, N. Y.
Cessna Aircraft Co., Wichita, Kans.
Chamberlin, Stanley F., New York, N. Y.
Clapp, Wm. F., Laboratory, Duxbury, Mass.
Climax Molybdenum Corp., New York, N. Y.
Comstock & Wescott, Inc., Cambridge, Mass.
Conn, C. G., Ltd., Elkhart, Ind.
Cook Research Laboratory, Chicago, Ill.

Cornell Aeronautical Laboratory, Buffalo, N. Y.
Coxhead, Ralph C., Corp., Washington, D. C.
Cushing & Nevell, New York, N. Y.
Davies Laboratory, Inc., Riverdale, Md.
De Florez Co., Inc., New York, N. Y.
Del-Pro Corp., Brooklyn, N. Y.
Displayers, The, New York, N. Y.
Dow Chemical Co., Midland, Mich.
Duncan & Bay, Inc., New York, N. Y.
Dunlap and Associates, New York, N. Y.
Dyna-Graphic Displays, Inc., Brooklyn, N. Y.
Educational Research Corp., Cambridge, Mass.
Educational Testing Services, Princeton, N. J.
Eitel McCullough Inc., San Bruno, Calif.
Engineering & Research Corp., Hyattsville, Md.
Engineering Research Association, St. Paul, Minn.
Enory Thurston Laboratory, Los Angeles, Calif.
Eppley Laboratory Inc., Newport, R. I.
Ethyl Corp., Detroit, Mich.
Exploration Contractors, New York, N. Y.
Experiment, Inc., Richmond, Va.
Fabric Research Laboratory, Boston, Mass.
Fairchild Corp., Farmingdale, N. Y.
Federal Tele-Communication Laboratories, Inc., Nutley, N. J.
Gardner, Robinson, Stierheim & Weis, Inc., Pittsburgh, Pa.
Gas Technology, Institute of, Chicago, Ill.
General Aniline & Film Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
General Mills, Inc., Minneapolis, Minn.
General Precision Laboratories, Inc., Pleasantville, N. Y.
General Tire & Rubber Co., Akron, Ohio
Goodyear Aircraft Corp., Akron, Ohio
Graham, Crowley, and Associates, Inc., Chicago, Ill.
Gray Research & Development Co., Inc., New York, N. Y.
Hefco Laboratories, Detroit, Mich.
Hillyer Instrument Co., Inc., New York, N. Y.
Horizons, Inc., Princeton, N. J.
House, Frederic, Inc., New York, N. Y.
Human Relations Area Filew, Inc., New Haven, Conn.
Hydrocarbon Research, Inc., New York, N. Y.
Hydrofoil Corp., Washington, D. C.
Industrial Scientific Co., New York, N. Y.
International Psychological Service Center, Washington, D. C.
Jam Handy Organization, Inc., Detroit, Mich.
Jackson-Moreland, Boston, Mass.
Koppers Co., Inc., Pittsburgh, Pa.
Lavoie Laboratories, Long Branch, N. J.
Lester Associates, Inc., New York, N. Y.
Link Aviation, Inc., Binghamton, N. Y.
Little, Arthur D., Inc., Cambridge, Mass.
Lockheed Aircraft Corp., Burbank, Calif.
Lorenz, Ben, Associates, New York, N. Y.
Maice Co., Inc., Minneapolis, Minn.
Martin, Glenn L., Co., Baltimore, Md.
Marton, Sander, Port Washington, N. Y.
Mass Photo Service, Inc., New York, N. Y.
Maurer, J. A., Inc., New York, N. Y.
McDonnell Aircraft Corp., St. Louis, Mo.
McGregor & Werner, Inc., Washington, D. C.
McKiernan Terry Corp., Harrison, N. Y.
Mellon Institute of Industrial Research, Pittsburgh, Pa.
Melpar, Inc., Alexandria, Va.
Metalectro Corp., Bladensburg, Md.
Metropolitan Electric Manufacturing Co., New York, N. Y.
Microcard Corp., La Crosse, Wis.
Mine Safety Appliance Co., Pittsburgh, Pa.
Morris & Walsh Typesetting Co., Inc., New York, N. Y.

National Technical Laboratory, Pasadena, Calif.
National Research Corp., Washington, D. C.
Newton Co., Middletown, Conn.
Ohio Chemical & Surgical Equipment Co., Madison, Wis.
Owens-Corning Fiberglass Corp., Toledo, Ohio.
Paxton, Krueger and Associates, Inc., New York, N. Y.
Peerless Instrument Co., Elmhurst, N. Y.
Pennsylvania Salt Manufacturing Co., Wyndmoor, Pa.
Perfection Blue Print Co., Inc., New York, N. Y.
Phillips Laboratories, Inc., Irvingston-on-Hudson, N. Y.
Polaroid Corp., Cambridge, Mass.
Psychological Corp., New York, N. Y.
Radio Corp. of America, Camden, N. J.
Raytheon Manufacturing Co., Newton, Mass.
Reaction Motors, Inc., Rockaway, N. J.
Reeves Instrument Corp., New York, N. Y.
Reflectone Corp., Stamford, Conn.
Remmey, Richard C., & Son Co., Philadelphia, Pa.
Richardson, Bellow, Henry & Co., Inc., New York, N. Y.
Rocky Mountain Research, Inc., Denver, Colo.
Roosevelt Field, Mineola, N. Y.
Saratoga Laboratories, Inc., Saratoga, N. Y.
Science Service, Inc., Washington, D. C.
Scott, Herman Hosmer, Inc., Cambridge, Mass.
Shell Development Corp., Emeryville, Calif.
Sound Masters, Inc., New York, N. Y.
Soundrive Engine Co., Los Angeles, Calif.
Sperry Gyroscope Co., Great Neck, L. I.
Springer, Earl W., Aircraft Radio Co., Indianapolis, Ind.
Square D Co., New York, N. Y.
Stanley Aviation Corp., New York, N. Y.
Stavid Engineering, Inc., Plainfield, N. J.
Sylvania Electric Products Co., Boston, Mass.
Texas Co., New York, N. Y.
Textile Research Institute, Inc., New York, N. Y.
Thermal Research & Engineering Corp., Waltham, Mass.
Timber Engineering Co., Washington, D. C.
Ultrasonic Corp., Cambridge, Mass.
United Aircraft Corp., Hartford, Conn.
United States Rubber Co., Naugatuck, Conn.
Venti-Davis, Inc., New York, N. Y.
Ventnor Boat Corp., West Atlantic City, N. J.
Watson Elevator Co., Englewood, N. J.
Western Electric Co., New York, N. Y.
Westinghouse Electric Corp., Pittsburgh, Pa.
Wood Work Specialties, Chicago, Ill.
Yoh, Hil. Co., Inc., Philadelphia, Pa.
Young, Richard E., New York, N. Y.
Zapffe, Carl A., Baltimore, Md.
Zerbee Celestial Fix Finder Co., Bellefontaine, Ohio
Zotoz, Dr. George A., New York, N. Y.

Governmental Agencies and Naval Activities

Central Intelligence Agency.
Department of Agriculture: Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Md.
Department of the Air Force: Air Matériel Command, Wright Field, Ohio.
Department of the Army: Office of the Quartermaster General, Signal Corps.
Department of Commerce:
    National Bureau of Standards, Washington, D. C.
    United States Weather Bureau.
    Civil Aeronautics Administration.
Department of the Interior:
    Bureau of Mines.
    United States Geological Survey.
Department of Labor: Bureau of Labor Statistics, Washington, D. C.

United States Public Health Service.
Library of Congress, Washington, D. C.
Department of the Navy:
Boston Naval Shipyard, Boston, Mass.
David Taylor Model Basin, Garderock, Md.
Naval Academy, Annapolis, Md.
Naval Air Station, Anacostia, D. C.
Naval Air Station, Quonset Point, R. I.
Naval Air Station, Patuxent, Md.
Naval Air Material Center, Philadelphia, Pa.
Naval Gun Factory, Washington, D. C.
Naval Medical Field Research Laboratory, Lejeune, N. C.
Naval Medical Center, Bethesda, Md.
Naval Observatory, Washington, D. C.
Naval Ordnance Test Station, Inyokern, Calif.
New York Naval Shipyard, New York, N. Y.

Senator O'MAHONEY. Of this $33 million you want for 1952, how much of that is to carry on work already initiated?

Admiral BOLSTER. I would say, actually, the continuing basic research program consists of approximately $15 million to carry on and extend this very good work in the area of basic research.

Now, the second part of this $33 million is to support what you can call applied research.

Senator O'MAHONEY. It would seem to me that your chief function would be in the applied research field.

Admiral BOLSTER. No, sir; we are responsible for the total research effort of the Navy.

We have a very great responsibility to do research in support of the material bureaus, and this is where our responsibility for applied research comes in.

Senator O'MAHONEY. These institutions, the list of which has just been provided to us, receives similar contracts from many other service agencies, do they not?

Admiral BOLSTER. They might receive contracts from other services. They might receive joint contracts. Frequently, we will embark on programs in which all three services are carrying out this type of program.

In cloud physics, for example, the three services are working together.

There are various types. The Office of Air Research is carrying out a program somewhat like ours and some of their projects are joint efforts with ours.

Now, it is extremely important that we have people doing programs of this type so that they will be familiar with the Navy's needs in these various areas. The current situation has certainly shown the value, historically, of having this type of program.

We have been able to go and get the solutions of very difficult problems, simply because we had identified people who were competent in these fields.

Senator O'MAHONEY. You asked here for approximately $4 million more than was received last year, and the intention is to devote that to additional applied research.

Admiral BOLSTER. Yes, sir.

Senator O'MAHONEY. Now, what particular projects do you plan to include in that $4 million that are not now being carried on?

Dr. PIORE. As you know, once the emergency developed, there were many scientists who essentially went to war. I mean, they wanted to go into applied areas.

Some of these groups have sort of joined up and started to do work. This past year they have just gotten started, and next year they will reach a level operation, a planned level of operation.

This money is required to support those groups. The areas involved include undersea warfare, air defense—there are also a number of electronics developments.

Most of the money goes into the university type of applied, classified venture. A small portion of it is going into industrial research laboratories, and this is to essentially get, as quickly as possible, certain valuable information out of the basic research and turn it into weapons.

DISCUSSION ON BASIC RESEARCH

Senator O'MAHONEY. What, in your judgment, is basic research?

Dr. PIORE. Basic research is an activity essentially to find out what makes the external world tick, to understand the atom, to understand how gasoline engines really get power out of gasoline. That is basic research.

Senator O'MAHONEY. That is what I thought.

That leads us to the question: Why should the naval laboratory be doing basic research?

Dr. PIORE. For a number of reasons.

Senator O'MAHONEY. And does it not necessarily result in duplication of effort since other laboratories are also engaging in basic research?

Dr. PIORE. Let me first answer the duplication question, and then answer the other question, if I may.

It is very difficult to create duplication in basic research. You would have to work hard to do it, really, for the following reasons:

Basic research is a nonclassified activity. Everyone knows what is going on in basic research.

A man in the University of Wyoming does not want to do the same type of work the man at Harvard is doing. Both of them publish the same work, and neither of them can get credit if they both do the same work.

So just by talking to people at Harvard or Wyoming, or Minnesota, you automatically divide the field in basic research.

People are interested in nuclear physics, simply nuclear physics, they do not duplicate each other, and this is the record throughout the world, essentially.

The Russians have sort of closed their doors on us, and there may be duplication in that area. But that is neither here nor there.

Then we have the problem of basic research and the interplay of basic research, applied research, and development. In those, one finds that, in order to have a strong development group, you have to back it up with applied research groups which, in turn, have to be backed up by basic research groups.

This is true if you are going to be in business for a long time. I think the best example of this is found in some of our large industrial concerns who have made a decision that they are going to survive for a very long time. You find that the telephone company puts a tre-

mendous effort on basic research. They have an applied research group and they have a development group.

The development is conducted by Western Electric. Most of the applied research and basic research occurs at the Bell Telephone Laboratory.

The same situation prevails in General Electric. You find that industries that have not been aggressive, technically, and there are a number of larger industries that have not followed this pattern, have to go in and, essentially, buy patents all the time in order to maintain technical progress.

The Navy intends to be in business for a long time. If it is going to have the healthy development program, it has to be supported by these two lesser programs. I mean, when you start developing, say, a new gun, you put a great deal of money into it, and because of the cost you cannot afford to gamble. You can afford to gamble in applied and basic research since you gamble in small sums. It not only provides new ideas, but you have people engaged in basic research and applied research getting interested right in the development problems of the Navy.

This emergency has demonstrated how we have been able to call on the people that have been conducting basic research for the Navy for the last 5 years, to essentially bear arms at this time and help out in technical areas of immediate importance.

We can go off the record at some point and give you example after example in antisubmarine warfare, air defense, et cetera.

Senator O'MAHONEY. Antisubmarine warfare is, of course, very necessary for the naval research to explore to the fullest possible limit.

But basic research is common to all the services.

Dr. PIORE. That is true.

Senator O'MAHONEY. So, in the philosophy of unification, why do the services not maintain one basic research institution instead of having two or three of them? We have to find some way to cut this appropriation down. I do not think we are going to make much headway with this research and development program, but somewhere we have to find a portion to take off.

Dr. PIORE. Let me just point out that there are certain areas in basic research that the Navy has primary interest. One such area is oceanography. The whole, more or less, survival of future antisubmarine warfare depends on strong oceanographic institutions in the country. No one else is really interested in oceanography.

This is sort of obvious. Another obvious area is hydrodynamics. The Navy is the biggest builder of ships and submarines, etc. The merchant marine building industry is not research. I mean, they will build the same ships over and over again.

All the progress has come from the Navy in the design of merchant ships.

This is a statement which is at least 90 percent correct.

Let me give another example. The magnetic effect over the ocean at low altitudes is an area in which no one is interested but the Navy.

Senator O'MAHONEY. You might be mistaken about that, sir. This committee, the committee which occupies this room ordinarily, the Committee on Interior and Insular Affairs, has before it now a bill to authorize special research in taking salt out of salt water so as to make more fresh water available for reclamation.

The Navy did some work on that for the purpose of providing fresh water to the occupants of your submarine fleets. The testimony that we have had would indicate that it was a rather expensive operation and one which would not yield commercial results.

It could not be used, for example, in the Virgin Islands to provide a supply of fresh water for the population down there. It could not be used to provide water for Central Arizona, which is very much in need of fresh water.

Then the whole question of seeding the clouds is one which I think would involve some of this basic research, of which you speak, and in which the Department of the Interior is as much interested as you are.

Why could you not work in that area with one institution instead of with several?

Admiral BOLSTER. I believe there is a very strong feeling, and I am sure that this is the belief of all of the people responsible for forward-looking programs, as Dr. Piore has pointed out, that all large development programs should be backed up by a good solid research program.

We have to have research in such fields as oceanography and the upper atmosphere, to understand what really causes such things to happen.

PERCENTAGE OF EXPENDITURES FOR RESEARCH

The Research and Development Board, as a matter of policy, has told the three departments that they should have approximately 6 percent of their total program in basic research.

Actually, the Navy has the larger part of the total work in this area simply because we have been aware of it longer. We have had an Office of Naval Research for the last 5 years. We have identified our research programs and have carried them out in a more orderly way, you might say, than the other services.

But I believe they are currently trying to increase their basic research programs simply because everyone that is responsible for development programs realizes the urgent need for carrying out research in the particular areas that your weapon developments need.

Senator O'MAHONEY. All right. Here we have $33 million for research by contract, so that it is not in your laboratory. If the Army is going into the same sort of research, by contract, and the Air Force by contract, then you may have the same institutions with contracts from the three services.

Dr. PIORE. I think that is not happening in this sense.

Senator O'MAHONEY. Is it happening in any sense?

Dr. PIORE. No.

You mentioned cloud seeding. This is a Signal Corps contract. It is a program with the Air Force supplying the aircraft and the Navy putting money into it.

The Navy has not gone to the same company or the same person and asked them to work on cloud seeding. You will find, as you go through these academic institutions, that there are very many contracts where one service holds the contract and the three services participate in them. In those areas, where there is a tripartite interest, there is tripartite participation. In other areas, you will find that the Army for example, is not concerned at all with the type of hydrodynamic research that we are. They have no interest and we support it completely.

QUESTION OF DUPLICATION

Senator O'MAHONEY. Of course, what I am getting at is whether or not there is duplication. I just would like to have the specific answer to that question.

Admiral BOLSTER. I can assure you that there is no duplication, Mr. Chairman.

Senator O'MAHONEY. And you screen every contract to make sure there is no duplication?

Admiral BOLSTER. Yes, sir; I can assure you of that, Mr. Chairman.

Senator O'MAHONEY. And, therefore, there is not an unnecessary expenditure of funds for an item of this kind.

Admiral BOLSTER. That is correct, sir.

Senator O'MAHONEY. Now, what have you to say about the reason why you did not do this work in your naval laboratory instead of letting it out by contract?

Have you done better by contract in the educational institutions and other scientific institutions to which you go?

Admiral BOLSTER. I think that one of the most important reasons that we do it by contract is to have access to the caliber of people that are available in the scientific institutions and which are not available in our laboratories. This in no sense, is meant to be a reflection on the very fine people we do have.

In the institutions, we have, at the present time, seven Nobel prize winners working on research in our programs. We have, if you wish for the record, a list of the type of scientists who are available to us and are currently being used as investigators on these programs.

They are the outstanding people in their fields.

Senator O'MAHONEY. We will be glad to have you put that in.

(The information referred to is as follows:)

Office of Naval Research Contractors—Nobel prize winners

Name	Affiliation	Field of science
William Francis Giauque	University of California	Chemistry.
Irving Langmuir	Research Laboratory, General Electric Co., Schenectady, N. Y.	Do.
G. H. Whipple	University of Rochester	Medicine and physiology.
H. C. Urey	University of Chicago	Chemistry.
Carl D. Anderson	California Institute of Technology	Physics.
Enrico Fermi	University of Chicago	Do.
Isador Isaac Rabi	Columbia University	Do.

SOME OF THE SCIENTISTS IN THE OFFICE OF NAVAL RESEARCH UNIVERSITY CONTRACT RESEARCH PROGRAM

Arctic biology:
- Giddings, James, University of Pennsylvania
- Wilbur, C. G., University of Missouri
- Washburn, A. Lincoln, Arctic Institute of North America

Biochemistry:
- Brand, Erwin, Columbia University
- Wald, George, Harvard University
- Van Neil, Cornelis, Stanford University
- Ochoa, Severo, New York University
- Hove, E. L., Alabama Polytechnic Institute

Biology marine:
- Smith, F. G. W., University of Miami
- Merriman, Daniel, Yale University
- Clapp, William F., W. F. Clapp Laboratories
- Hasler, A. D., University of Wisconsin
- Wilbur, Karl, Duke University

Biophysics:
Davis, Hallowell, Central Institute for the Deaf
Hartline, H. Keffer, Johns Hopkins University
Zirkle, Raymond E., University of Chicago
Beadle, George, California Institute of Technology
Hardy, James, Cornell University
Chemistry:
Aston, J. G., Pennsylvania State College
Eyring, Henry, University of Utah
Hildebrand, J. H., University of California
Kistiakowsky, G. B., Harvard University
Noyes, W. A., Jr., University of Rochester
Kirkwood, J. G., Yale University
Dentistry:
Appleton, J. L. T., University of Pennsylvania
Becks, Herman, University of California
Peyton, Floyd A., University of Michigan
Electronics:
Smith, L. P., Cornell University
Von Hippel, A. R., Massachusetts Institute of Technology
Stratton, J. A., Massachusetts Institute of Technology
Terman, F. E., Stanford University
Wiesner, J. B., Massachusetts Institute of Technology
Lark-Harovitz, K., Purdue
Geography:
James, P. E., Syracuse University
Russell, Richard J., Louisiana State
Geophysics and oceanography:
Eckart, C., University of California
Ewing, M., Columbia University
Iselin, C. O'D., Woods Hole Oceanographic Institution
Rossby, C. G., University of Chicago
Tuve, M. A., Carnegie Institute of Washington
Birch, F., Harvard University
Revelle, R. R., Scripps Institute of Oceanography
Hydrodynamics:
Bakhmeteff, B. A., Columbia University
Davidson, K. S. M., experimental towing tank, Stevens Institute of Technology
Knapp, R. T., California Institute of Technology
Rouse, H., University of Iowa
Straub, L. G., University of Minnesota
Logistics: Morgenstern, O., Princeton University
Mathematics:
Courant, R., New York University
Prager, W., Brown University
Birkhoff, G., Harvard University
Feller, W., Cornell University
Wilks, S. S., Princeton University
Morse, M., Institute for Advanced Study, Princeton
Stone, M. H., University of Chicago
Von Neumann, J., Institute for Advanced Study, Princeton
Mechanics:
Bleakney, W., Princeton University
Boelter, L. M. K., University of California, Los Angeles
Nemark, N. M., University of Illinois
Timoshenko, S. P., Stanford University
Wislicenus, G. F., Johns Hopkins University
Medicine:
Whitehead, R. W., University of Colorado
Coggeshall, R. T., University of Chicago
McCulloch, W. S., University of Illinois
Shumacher, H. H., University of Indiana
Evans, E. I., Medical College of Virginia
Metallurgy:
Chipman, J., Massachusetts Institute of Technology
Mehl, R. E., Carbegia Institute of Technology
Smith, C. S., University of Chicago

Microbiology:
Krueger, A. P., University of California
Reyniers, James, University of Notre Dame
Nungester, Walter, University of Michigan
Sherwood, N. P., University of Kansas
Syverton, J. T., University of Minnesota
Nuclear physics:
Allison, S. K., University of Chicago
Bainbridge, K. T., Harvard University
Bethe, H., Cornell University
Bloch, F., Stanford University
Brode, R. B., University of California
Kerst, D. W., University of Illinois
Mitchell, A. C., University of Indiana
Lauritsen, C. C., California Institute of Technology
Purcell, E. M., Harvard University
Rossi, B., Massachusetts Institute of Technology
Wheeler, J. A., Princeton University
Zacharias, J. R., Massachusetts Institute of Technology
Fermi, E., University of Chicago
Rabi, I. I., Columbia University
Williams, J., University of Minnesota
Personal training:
Guilford, J. P., University of Southern California
McNemar, Quinn, Stanford University
Stuit, D. B., University of Iowa
Thorndike, R. L., Columbia University Teachers College
Viteless, M., University of Pennsylvania
Physics:
Nielson, H., Ohio State University
O'Brien, B., Rochester University
Spitzer, L., Princeton University
Wilson, E. B., Jr., Harvard University
Hill, A. G., Massachusetts Institute of Technology
Seitz, F., University of Illinois
Pipensky, R., Penn State
Ziegler, W. T., Georgia Tech.
Mulliken, R. S., Chicago University
Cross, P. C., University of Washington
Guth, E., Notre Dame
Bennett, W., Arkansas University
Strong, J. D., Johns Hopkins University
Grosse, A. V., Temple University
Herzfeld, K. D., Catholic University
Physiology:
Bonner, J., California Institute of Technology
Fenn, Wallace O., University of Rochester
Hoagland, Hudson, Worcester Foundation
Gerard, R. W., University of Chicago
Warren, J. V., Emory University
Davenport, Horace, University of Utah
Psychophysiology:
Carmichael, Leonard, Tufts College
Geldard, Frank, University of Virginia
Graham, C. H., Columbia University
Mann, C. W., Tulane University
Stevens, S. S., Harvard University

Admiral BOLSTER. We cannot induce this type of man to accept employment in a Government laboratory.

Now, it is also true that we in the Government laboratories, and this is probably not as true of the Naval Research Laboratory as in other naval laboratories, but, in general, the naval laboratories are working on equipments that are pretty near to the finished product and, therefor, they are not available for the forward-looking things that go in some of these programs we have in universities.

There is another area of responsibility that is being paid for out of this $33 million. The Office of Naval Research is responsible for the minimum Navy portion of the large joint projects that are now being conducted in such areas as air defense.

They are joint projects in every case, Army, Navy, Air Force, all participating, and we have, in our budget, the minimum cost of the Navy participation of those projects.

Senator O'MAHONEY. What do you mean by the minimum cost?

Admiral BOLSTER. Well, actually, the program would require a certain amount of operations and people.

In the air-defense activity at MIT, for instance, there is a certain cost to the Department of Defense to carry out this operation.

The Office of Naval Research is paying the minimum Navy share of this cost, and the other bureaus would only contribute for specific projects for development of equipments for them.

Senator O'MAHONEY. Of the 33,000,000, $33,668,000, in this item of contract research, how much is for such joint research programs in which the three services are united?

Admiral BOLSTER. I think a very good estimate on that, and it is strictly an estimate, would be on the order of $3 million.

Is that about right?

Dr. Piore says five.

Dr. PIORE. We can give you an exact figure tomorrow.

Senator O'MAHONEY. I think it would be a good idea to get that in there.

(The information referred to is as follows:)

The estimate is $5,800,000.

TELEVISION TRAINING

On page 11, there is a mention of television training. Is it worth while? How much are you going to spend on that?

Admiral BOLSTER. Actually, this work in the application of television to mass training techniques is a program that was carried out during the last—well, I think at least the last 3 years. I was not in the Office, but I believe it is 3 years.

I would feel that this program is pretty well completed unless the Chief of Naval Personnel asks us to engage in more elaborate and extensive projects.

What we did in the earlier phases, was to broadcast training programs to the Reserve personnel at Anacostia and in New York, and at places where it could be received.

We actually had regular drills that were conducted by means of the television technique to see, actually, if it was an effective way of conducting training of large groups.

This program was carried out and was analyzed. To my knowledge, there is a relatively small amount in this budget for that specific purpose.

Senator O'MAHONEY. What is the relative small amount?

Admiral BOLSTER. I would estimate that it would be on the order of between thirty to fifty thousand dollars; something in that order.

Senator O'MAHONEY. One of the officers here the other day expressed the feeling of doubt about the value of motion pictures in training. I have no opinion, myself, on the television.

Dr. PIORE. We have a contract with Fordham University to look into the effectiveness of training by television, and to try to ascertain whether it is worth expanding the program on the basis of what the people learned.

NAVAL RESEARCH LABORATORY

Senator O'MAHONEY. You have a word or two to say about the maintenance and operation of research facilities, I suppose, on page 15.

Admiral BOLSTER. Yes, sir.

The maintenance and operation activity consists of the maintenance and operational costs of our field activities. The cost for the Naval Research Laboratory does increase slightly from $8,000,000 to $8,410,000.

These are discussed in detail under each laboratory. I can read from the record, or just discuss them, however you wish.

Senator O'MAHONEY. Just discuss them briefly.

Admiral BOLSTER. The cost of the Naval Research Laboratory has increased, primarily because the level of operations down there has expanded greatly.

We operate at the Naval Research Laboratory with funds provided both in direct research by the Office of Naval Research and from outside agencies.

We do work for the bureaus; we do work for the Air Force, and we do work for the Army. We do large amounts of work for the Atomic Energy Commission.

This has expanded the level of operation of the Naval Research Laboratory and necessarily has increased our maintenance costs.

The ratios have decreased, however.

SPECIAL DEVICES CENTER

The same general remarks apply to the operation at the Special Devices Center.

The work at the Special Devices Center has increased greatly during fiscal 1951 due to the impact of the accelerated defense programs in general. We have many more military personnel coming into service, and we have had to expand and accelerate the rate at which we are able to develop our training equipment.

This results in more people being on board and consequently a more intensive use of space and facilities. This results in an increased maintenance cost.

UNDERWATER SOUND REFERENCE LABORATORY

The Underwater Sound Reference Laboratory shows a fairly constant level.

The Underwater Sound Reference Laboratory is the Navy's one laboratory working in the field of standards for underwater sound and equipment. We provide standards that are sent out to industrial laboratories and naval laboratories developing underwater sound equipment, by which they will be provided with standard reference equipment.

Maintenance costs of this facility remain at a constant level.

Senator O'MAHONEY. What functions do the branch-office staff have to perform with these contractors who run the research programs?

Admiral BOLSTER. The branch offices provide a field contact point between the Office of Naval Research and the institution. They have the responsibility for liaison with the project investigators to see what work is going on and what progress is being made.

We also have, in the branch office, personnel to look out for the patents in that area.

I think, though, that the most important function of the branch offices is to provide in the field a staff of people who speak the same language as the normal research man in the university. It was found in the early days of the Office, that you could not use the normal Navy inspector who was used to inspecting boilers or engines, to work closely with the universities in the administration of scientific research projects.

So we have actually created these small branch offices in the key areas, and they carry out the continuing liaison with the contractors, much as other agencies do in the material development program.

DEPARTMENTAL ADMINISTRATION

Senator O'MAHONEY. You ask about $54,000 more for departmental administration. How many persons are on the staff? That is on page 22, in the justification.

It stated that two-thirds of the number of employees are scientific and technically trained persons, and that only one-third are employed for general administration, financial management, and the like.

TOTAL PERSONNEL

Admiral BOLSTER. I think you asked me how many total personnel we had. Four hundred twenty-three is the total current complement.

Senator O'MAHONEY. Would that not be enough to do throughout the year?

Admiral BOLSTER. There is no increase, is there?

Senator O'MAHONEY. There is an increase of $540,000 practically.

Mr. EDWARDS. Senator, the increase is to take care of having these people on a full-year basis in 1952, where they are only there on a part-year basis in the years 1950 and 1951.

During the year 1950 and 1951, personnel were recruited to carry on this expanded program, but in 1952 they will be there for a full year.

Senator O'MAHONEY. Do you want the record to show that you are not increasing the staff?

Admiral BOLSTER. That is correct for the departmental service.

POSSIBLE EFFECT OF 10-PERCENT CUT

Senator O'MAHONEY. On several of the bills, you know, there have been amendments to cut administrative costs by 10 percent; that is, administrative costs spent on personnel. Do you have any comment to make on that? What would be the effect on research and development?

Admiral BOLSTER. It would be a very severe effect on the ability of our people to do our work.

Senator O'MAHONEY. Your estimate in 1951 was $2,200,000 as compared with obligations of $1,443,699 in 1950.

There was an increase in 1951 of something more than $500,000, and now we have another 500,000 increase.

Admiral BOLSTER. Actually, I think, as Mr. Edwards has said, this increase in 1952 is merely the fact that these people will be there the whole year.

Senator O'MAHONEY. One moment, please.

I am referring to the justification on page 23. An increase of $538,000 was requested in fiscal 1952. This is composed of an increase of $388,000 to cover six new positions and to continue in 1952 the level of operation attained late in fiscal 1951, and a nonrecurring item of $150,000 to provide for the cost of moving the Washington office to a new location in 1952.

Where is the Washington office now?

Admiral BOLSTER. You had better answer that, Mr. Edwards.

Mr. EDWARDS. Senator, during the year of 1951, there was a great deal of pressure to move the Office of Naval Research out of Washington.

Senator O'MAHONEY. Pressure from what source?

Mr. EDWARDS. When a considerable number of people were being hired in Washington, space became somewhat at a premium. While I cannot speak for the Navy on this, they needed the space and they designated some organizations to move somewhere else.

The Office of Naval Research was one of those organizations.

At that time, we requested that we include money for making such a move if necessary. That money has now been put in an administrative reserve by the Navy and will not be used for any other purpose.

Senator O'MAHONEY. Was it in the 1951 bill?

Mr. EDWARDS. No, it is in the 1952.

But with the appropriation authorization we now have, we have taken steps to put it in a reserve, anyway. We will not use it under any circumstances unless we are ordered to move out of Washington and have to pay the costs.

Senator O'MAHONEY. Have you not succeeded in persuading the authorities to keep you in Washington?

Mr. EDWARDS. I would like to think that we have, Senator.

Senator O'MAHONEY. Perhaps if we take the money out, you will have to stay here.

But there are six new positions?

NEW POSITIONS

Mr. EDWARDS. There are six new positions; yes, sir.

Senator O'MAHONEY. What are they?

Mr. EDWARDS. They are scientific positions, but I do not think I can give you the exact titles. I can get them and put them in the record, if you like.

(The information referred to is as follows:)

1 mathematician
1 biochemist
1 electronic engineer
1 nuclear physicist
2 clerk-stenographers

Senator O'MAHONEY. Are they really necessary?

Mr. EDWARDS. The scientists say they are.

Dr. PIORE. They are necessary. The workload has increased tremendously in administering the applied research program. You have to spend much more time to get the work; you have to keep pressure on people to get the work out.

Senator O'MAHONEY. Is your research confined to scientific matters?

Admiral BOLSTER. I do not think that that would be an entirely true statement.

Senator O'MAHONEY. Well, scientific and technological and mechanical?

Admiral BOLSTER. We are essentially in the scientific field. This requires, in such areas as we are trying to develop, say, a new technique—if you mean, do we employ only scientists, we employ both scientists and engineers, yes.

Senator O'MAHONEY. But do you do any personnel research, for example?

Admiral BOLSTER. Only to the extent that we are interested in evaluating such things as the efficiency of these training equipments, we have that type of research. There is a research and development operational requirement in human resources, psychological warfare, and that sort of work. We do work for the Bureau of Personnel in this field of understanding how to train men.

Our human resources program is part of the total program, and there are funds in here for that purpose.

Dr. PIORE. I would say it is about $300,000 for research in the field of selection of military personnel.

Senator O'MAHONEY. You would tell me how you would spend $300,000 of that?

Dr. PIORE. This is a program which is developed between the Office of Naval Research and the Bureau of Naval Personnel. The major areas it hits are trying to evolve methods, better methods of selection of men for jobs. Also, getting better methods of trying to pick the men for more sophisticated jobs, and also methods concerning certain equipments.

We have certain types of equipment in the Navy that require certain qualifications.

Here are the actual titles: Testing devices and sensatory devices. We want to know how good people's eyes are for specific jobs; how well they hear. Then there is the selection classification of people.

Admiral BOLSTER. This is how you tell whether a recruit ought to be an airplane operator or should he be a man who works as a deckhand, or should be work in the engineers' quarters.

It is helping the Bureau of Personnel in their classification methods.

You would actually hire professional people in this field to do that.

Senator O'MAHONEY. How many persons are so employed?

Admiral BOLSTER. In our office, very few. But do you mean in the contracting office?

Dr. PIORE. We have a program of about $300,000, and I would judge that costs, say, about $15,000 a person to support.

Senator O'MAHONEY. Is this a contract job?

Dr. PIORE. Yes, that is right. We have professors of psychology, of people trained in educational methods, to help us make these studies. We do not do them ourselves.

Senator O'MAHONEY. Are they listed?

Admiral BOLSTER. Some of them are. I will have to check precisely. This list we have here is more of a sample.

Yes, there are psychologists listed. Yes, five of them are listed, five outstanding ones.

Senator O'MAHONEY. How about information and publicity? Do you have any people employed for that?

Admiral BOLSTER. No, sir.

In our own organization, we are required to have a technical information officer as a part of an organization.

I have a WAVE officer on duty in my organization that does this; but we have no fund in this appropriation for publicity purposes at all.

TECHNICAL INFORMATION OFFICER

Senator O'MAHONEY. What does this technical information officer do?

Admiral BOLSTER. Actually, we get calls from newspapers about things that they have heard rumors about, are we going to develop a new thing, and is it true? She has to worry about the calls that come in from magazines which are generating articles.

We actually work very closely with the Department of Defense in the whole orderly handling of public information.

Senator O'MAHONEY. Since you mentioned newspapers, I wish you would develop a technique by which members of Congress would be kept as well advised as the reporters of Washington as to what is going on.

Admiral BOLSTER. You see, frequently there will be articles printed in scientific journals that had to do with some result or some project. A man may read that and he will write in and want to know more about it. This WAVE officer will know where he can go to get more information.

If it is classified, she will tell him that he cannot have any more information.

Senator O'MAHONEY. So the duty of that person is to answer inquiries from the public?

Admiral BOLSTER. That is correct.

Senator O'MAHONEY. And it is not to promote publicity?

Admiral BOLSTER. That is correct.

She actually acts as a go-between between people seeking information and where they can get the information.

Senator O'MAHONEY. Admiral Clexton, let me tell you that before we close you should be prepared to discuss this question of personnel for the whole Navy.

Captain FURTH. I think that the term you used, "technical information officer," should be changed to "public information officer" because there is a marked difference between those two terms.

We do have a technical information officer who is responsible for producing the approved research reports and publishing them if they are unclassified.

Admiral BOLSTER. That is not what the Senator is talking about.

Captain FURTH. I know, but that went in on the record. It is public information.

Senator O'MAHONEY. We have spent a good deal more time on this than I had intended to at the outset, Admiral. It was and is a very interesting subject.

Research always is interesting. Let me close by calling your attention to page 30. This, I take it, is merely a comparison of the position used in the patents program.

Admiral BOLSTER. Yes, sir. That was merely showing the current distribution of the personnel in the patent organization in the field, to show how we are placing people who can do patent work in the various naval activities.

Senator O'MAHONEY. You have increased the number of positions from 129 in fiscal 1951 to 144 in fiscal 1952. In 1950, you got along with 80.

Is 144 necessary?

Admiral BOLSTER. Well, actually, the story was and is that we did not get along in fiscal 1950. The work was not properly done and as I said earlier, the Navy's patent responsibilities were not properly carried out. This, I feel, is a very important function and we need every man we have listed here in order to do the work that should be done.

As I said earlier, also, we get back in savings tremendous amounts of money from this endeavor. It is a very worth-while function.

Senator O'MAHONEY. I notice a proviso has been dropped from the language which made certain funds available until June 30, 1951, for the liquidation of obligations.

That is no longer necessary, is it?

Admiral BOLSTER. That is no longer necessary.

Senator O'MAHONEY. Well, Admiral, is there anything else you would like to add for our information?

Admiral BOLSTER. No, sir.

Senator O'MAHONEY. Thank you very much. We very much appreciate the presentation.

SERVICE-WIDE SUPPLY AND FINANCE

REQUEST FOR LANGUAGE CHANGE

Admiral CLEXTON. The next appropriation will be "Service-wide supply and finance" to be justified by Admiral Fox, Chief of the Bureau of Supplies and Accounts. He will also justify the "Naval stock fund."

This afternoon, we were able to get permission from the Bureau of the Budget to request a change in language, which is not incroporated in the President's budget.

Senator O'MAHONEY. Where will that appear Admiral?

Admiral CLEXTON. It would be added to the language which is now in the President's budget under "Service-wide supply and finance."

Senator O'MAHONEY. Let us see where that appears.

On page 414 of the bill, it provides as follows:

For expenses necessary for maintenance and operation of servicewide supply and finance activities, including supply depots and centers, clothing depots, market and purchasing offices, supply demand control points, fleet fueling facilities, overseas air cargo terminals, regional accounting and disbursing offices, the material catalog office, the cost inspection service, and other servicewide supply and finance facilities, as designated by the Secretary; procurement of supplies, services, special clothing, and equipment; rent; intra-Navy transportation of things—and the phrase "including contract operation of tankers" is dropped—all transportation of Navy stock fund—and the phrase "and clothing and small stores fund" is dropped—material and transportation of household effects; re-

search and development; industrial mobilization; losses in exchange and in the accounts of disbursing officers, as authorized by law; and departmental salaries.

Admiral CLEXTON. The language which we have permission to request from the committee is:

Provided, That, under such regulations as the Secretary of the Navy may prescribe, the household goods and personal effects of civilian professors and employees of the Naval Postgraduate School may be transported during the current fiscal year, in connection with the movement of the Postgraduate School from Annapolis, Maryland, to Monterey, California, without regard to the weight limitation per household provided for in section 1 of the Act of August 2, 1946 (60 Stat. 806), as amended (5 U. S. C. 73 b–1): *Provided further*, That the average uncrated weight per household, exclusive of professional books, papers and equipment of such professors and employees which may be transported at government expense, shall not exceed seven thousand pounds.

Admiral Herrmann, who is superintendent of the Postgraduate School, is here to tell you the reason for this language.

Senator O'MAHONEY. This, of course, is legislation. You have not presented this to the House?

Admiral CLEXTON. We presented it to the House informally inasmuch as the hearing at the Bureau of the Budget had not been completed, and we did not have the permission of the Bureau of the Budget.

Senator O'MAHONEY. But since you received permission from the Bureau of the Budget, have you presented it to the House again?

Admiral CLEXTON. We asked the House and they would prefer for us to bring it to the Senate. They have been informed of it for the conference. They would then be able to discuss it.

Senator O'MAHONEY. There is considerable reluctance to the placing of legislative provisions in the bill in the Senate. It has been done, of course, and inasmuch as the House has not drafted the bill yet, it would seem that there might still be an opportunity for them to put in on.

But, in any event, Admiral Herrmann, we will be very glad to have your statement. I am sorry you had to wait so long.

STATEMENT OF REAR ADM. E. E. HERRMANN, SUPERINTENDENT, UNITED STATES NAVAL POSTGRADUATE SCHOOL, ANNAPOLIS, MD.

Admiral HERRMANN. By act of Congress, approved on the 31st of July 1947, Public Law 302, Eightieth Congress, the establishment of the Postgraduate School at Monterey was approved, and the authority at that time was limited to funds which would permit the immediate activation of a portion of that facility to accommodate the General Line School, which is a portion of the Postgraduate School, and also to transfer to it a portion of our Engineering School located at Annapolis.

The time has come to carry out the remainder of the full plan, namely, to consolidate the activity by moving to Monterey the portion remaining at Annapolis, which is the Engineering School.

An essential ingredient of the project of moving the Postgraduate School, which is a graduate school is, of course, the moving of the faculty. Without the faculty, the school would cease to exist.

I woul say that losing any substantial portion of its faculty would very greatly disrupt the school, and it would probably put it out of

business for a period, I would estimate, of not less than a year, before we could reassemble the kind of people that we require.

In analyzing the problem of moving, under the terms of Executive Order 9805, dated November 25, 1946, which, in turn, is based on Public Law 600, I believe, of the Seventy-ninth Congress, which places the 7,000-pound ceiling on any individual without regard to whether he is a GS–2 or GS–18, and considering the group that we have, which are largely mature people well up on the scale, we find that that ceiling is utterly unreasonable in comparison with the kind of households these people actually have.

For these people to move under that limitation would result in costing them, individually, I would say from $400 or $500 up to in excess of $1,000.

In other words, it would become necessary, then, for these people, in order to remain with the school, to pay for the privilege plus, of course, the natural inconvenience and disruption in domestic affairs incident to moving a household 3,000 miles.

Senator O'MAHONEY. How many such individuals are there?

Admiral HERRMANN. Our faculty numbers 69.

Senator O'MAHONEY. Would there be any objection to writing that number in?

Admiral HERRMANN. Well, I should think not.

Senator O'MAHONEY. You have a limitation on the poundage that may be transported, and I observe that that has been scaled down from 8,500 to 7,000.

Admiral CLEXTON. You see, Senator, information from the budget hearing has been coming in to me all during this hearing, as changes recommended by the Budget Bureau.

Admiral HERRMANN. We had a rather extensive discussion in the Bureau of the Budget, Mr. Chairman, just before we came here. It was thought better to preserve the 7,000-pound figure on this basis: that the Government committed itself to 7,000 pounds for any individual, and that it would be reasonable to accept this figure as the average for a group such as the Postgraduate School faculty.

The problem we have is that there is a distribution of younger people and older people, some having less than 7,000 pounds, some having more than 7,000 pounds. We have to try to distribute the difference in such a way as to come out with an average of 7,000 pounds.

Senator O'MAHONEY. Are they all willing to go?

Admiral HERRMANN. This would have a very great deal to do with it, Mr. Chairman.

We are, to begin with, in competition constantly with other technical educational institutions like MIT, California Tech, and RPI, and Government laboratories and industrial laboratories for our people, for these institutions are willing to pay them quite a little more than they get from the Postgraduate School.

Our faculty stay with us because they like us and they like the kind of thing they are doing. They will stay as long as they can afford to.

But when it comes to considering not only the differential of salary that they might get elsewhere, but also the problems attendant upon having to move with the school from Annapolis to California, I cannot expect them to stay if on top of these other considerations they would also be put to personal expense in making the move. I

am afraid that I might lose from 40 to 50 percent of my faculty which, in my opinion, would do great harm to the Postgraduate School.

At the present time, the school is in very limited quarters, very cramped, and it needs relief.

Dean Glasgow of our faculty is present, and might add some civilian slant on this.

Senator O'MAHONEY. Is the dean here?

TRANSFER OF NAVAL POSTGRADUATE SCHOOL

STATEMENT OF DR. R. S. GLASGOW, ACADEMIC DEAN, UNITED STATES NAVAL POSTGRADUATE SCHOOL, ANNAPOLIS, MD.

EXPENSES OF TEACHING STAFF

Dr. GLASGOW. In support of Admiral Herrmann's statement, the morale of the faculty with respect to this impending move is somewhat low, what with being uprooted, having to dispose of their homes in Annapolis, probably to financial disadvantage, and being confronted with the prospect of having no living quarters at Monterey where housing is somewhat in short supply. That will necessarily result in some financial hardships, no doubt.

Then, if on top of it all, they have to be out-of-pocket for perhaps 2 months' salary as a result of having moved for the Government's convenience, it has introduced a morale problem which is very unsatisfactory.

Senator O'MAHONEY. This move has been in contemplation for 3 years at least, I understand.

Dr. GLASGOW. Yes, for some time. Now, they are being confronted with the grim facts of life.

Heretofore it has been, "Yes, we are going to California, and that is a beautiful spot." But you do not get down and analyze the details nearly as thoroughly as when the move actually confronts you, as it does now.

Senator O'MAHONEY. Have such indications been made to you by individual members of the faculty?

Mr. GLASGOW. Several of them have told me they do not see how they possibly can afford to go.

Senator O'MAHONEY. Do you think this would enable them to go?

Dr. GLASGOW. It will be of considerable help, yes.

It is not as generous as I would like to see it, Senator, but I guess the Government cannot afford to be as generous as private corporations.

I know when Shell Oil moved from St. Louis, which was my home a little while ago, the entire move was accomplished at no expense to the employees.

Senator O'MAHONEY. There is not a great deal involved in it, but I am trying to make a record so there will be something for the other members of the committee, in view of the lateness of the hour.

You speak of 2 months' salary. What is the average salary of the members of your organization?

Dr. GLASGOW. Around $6,500, or $6,700, I would judge, considering the entire faculty.

Senator O'MAHONEY. If this were done, would they go?

Dr. GLASGOW. A good many more would be able to make up their minds favorably, I think.

Senator O'MAHONEY. Whether it is an incentive or not, you feel that the allowance should be made for the members of the faculty anyway?

Dr. GLASGOW. I think it should, sir.

NUMBER OF PERSONNEL

Senator O'MAHONEY. How many naval personnel are involved?

Admiral HERRMANN. The staff of the school are 21 in number, civilian employees who would go along under civil service, classified, on the order of 30. Students at the present time number 375.

Senator O'MAHONEY. I am trying to determine how many naval personnel, strictly Navy personnel, there are.

Admiral HERRMANN. The school is staffed with 21 naval officer personnel, and the students number 375.

Senator O'MAHONEY. Students probably have no homes to transport furniture from.

Admiral HERRMANN. Well, they have household allowance scales which happen to be quite generous compared to the 7,000-pound allowance for civilians, because an ensign's allowance for household effects is 7,000 pounds, which is the maximum for a civilian.

Senator O'MAHONEY. What I am getting at is that I want the record to show that all of the naval personnel will have their effects transported.

Admiral HERRMANN. The naval personnel will have their effects transferred under the naval scale, which runs from 7,000 to 12,000 pounds.

Senator O'MAHONEY. And what you want is to provide transportation for about 69 civilian faculty members who, without this provision, would have to pay for the transportation of their own effects.

Admiral HERRMANN. Or a considerable portion of them.

Senator O'MAHONEY. Why do you say a considerable portion?

Admiral HERRMANN. A considerable portion thereof because the Government, under the present regulations, will transport only 7,000 pounds, and anything in excess of that they would have to pay for themselves.

Most of the households of the more senior people will run on the order of ten, eleven, or twelve thousand.

Senator O'MAHONEY. Is there anything more that you feel should be put in the record?

Admiral HERRMANN. No, sir.

Admiral CLEXTON. We were getting here some estimates of the cost of transporting 7,000 pounds, 3,000 miles, and it appears to approximate $1,320, which, times the 69 people, would not be a very large amount of money.

Senator O'MAHONEY. Did the Budget cut you from 8,500 pounds to 7,000?

Admiral CLEXTON. The Bureau of the Budget would not permit us to ask for 8,500 pounds.

Admiral HERRMANN. We thought, Mr. Chairman, that 8,500 pounds would give us some safety factor and not necessitate too strict policying of the household effects to be shipped.

Under the 7,000-pound figure, it would be necessary for the dean and myself to practically police households and make the people discard stuff which might be spared. But, though that would be an

arduous chore, I feel that we can accomplish it and can get by with a 7,000-pound average.

I think that it would be a very substantial assist in keeping the people from taking this occasion to separate from the school.

Senator O'MAHONEY. The postgraduate school is a necessary institution?

Admiral HERRMANN. I would say very necessary.

Senator O'MAHONEY. Well, that is all I can think of asking.

If you want to polish the record up any further, Admiral, you may.

Thank you very much, Dean, and Admiral Herrmann.

Admiral CLEXTON. It has been brought out here that the laws cited in the language permit the transshipment of 7,000 pounds for each individual civilian, and that would be done on a separate contract for each civilian.

Senator O'MAHONEY. So that the only effect of this language is to allow the members of the faculty, the civilian members of the faculty, to pool their material?

Admiral HERRMANN. Yes, sir; that is it.

Senator O'MAHONEY. So that a professor with 10,000 pounds could have his 3,000 possibly carried by some other member of the faculty who had only 4,000 pounds.

Admiral HERRMANN. That is correct, sir. That is exactly it.

Senator O'MAHONEY. So it is merely an authorization for pooling this transportation. I did not understand it.

Now, I think that clarifies the record.

Admiral HERRMANN. In the end, it would not cost the Government any more than if we happened to have 69 professors who each happened to have 7,000 pounds.

This merely permits flexibility.

Senator O'MAHONEY. Thank you very much.

The committee will stand in recess subject to the call of the Chair.

(Thereupon, at 5:05 p. m., Thursday, July 19, 1951, the hearing recessed, to reconvene subject to call of the Chair. The committee was called to resume hearing on Friday, July 20, 1951.)

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